ELECTRICAL REVIEW

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Emphasis on Research

THE seven papers on research activities presented at the British Electrical Power Convention and reported in this issue were well chosen to demonstrate the very varied nature of the scientific sources of electrical progress and at the same time their close interlinkage. They indicate the extent to which further developments will depend not only on interpretation of purely electrical phenomena but also on advances in such fields as thermodynamics, physics, chemistry and metallurgy. Since consumption of electricity is a measure of a country's industrial status and living standards, it is of especial importance that new fundamental knowledge should continually be acquired and then put to use as quickly and economically as possible. It is of comparable importance that the limited funds and trained brain power available for research should be correctly allocated between the two types.

In Great Britain economy of effort and hence of financial outlay is secured through a widespread appreciation of the gains that accrue from methods of co-operation which allow free play to competition of a diversity of talents. Nevertheless there is considerable force in Dr. S. Whitehead's view that too small a proportion of the electrical industry's revenue goes to its co-operative research association, the E.R.A., which covers both fundamental and applied kinds. Moreover it is understood that support is not so liberal from concerns without research establishments which would most profit by its work. Electrical engineers are naturally more closely interested in the kind of research that is applied to secure definite results than that which pursues scientific knowledge without direct concern for immediate purpose. Consequently they tend to regard the two classes as short-term and long-term aspects only. This preference has the justification, to which Sir Arthur Fleming referred, that applied research reduces the time lag between scientific discoveries and their practical exploitation, the most obvious example of which is the loss of half a century between Faraday's discovery of electro-

magnetic induction and the beginnings of public electricity supply. It may be, too, that scientific knowledge is accumulating more quickly than it can be translated into the usable form needed under present conditions. Allowance must be made, also, for a growing tendency for engineers engaged in production and utilization to take the initiative in specifying what they will require a few years hence and to base their plans on faith in the ability of research scientists to meet their needs.

THE INDUSTRIAL STRUCTURE

In his address as president of the Power Convention Mr. P. V. Hunter examined the basic organization of industry with the idea of ascertaining whether the present structure, built up over many years, is suited to modern conditions. He made some reference to American industry to show that while in this there were some features which might be emulated here, conditions in the two countries differed too much to warrant a wholesale adoption of American methods. Mr. Hunter defended the much maligned trade associations. Upon the whole he thought it doubtful whether in such an old-established industrial community as ours any system other than the one which had gradually been evolved would have given better service to the community.

DOMESTIC ECONOMY

The first group of papers presented at the Convention set out the case for the domestic use of electricity in a twofold way. Mr. R. Y. Sanders (B.E.A.) showed that electrical methods were beneficial and advantageous to the public and that without a balancing domestic load the electricity supply industry could not give industry such a cheap supply as it now receives. The paper should prove a useful source of reference for students of this complicated subject. Equally the three supporting papers by Messrs. C. H. Smith (water heating), J. A. Fraser (cooking) and R. Berry ("comfort" heating) should serve as concise "text-books" to their particular subjects. Above all this set of papers will provide ammunition in the electrical industry's struggle against its detractors.

CAPACITOR DIELECTRICS

One of the B.E.P. Convention papers mentioned the revolutionary changes which the construction of power capacitors may undergo if one or other of the newer insulating substances now becoming available can be employed economically. It seems that the U.S. Naval Research Laboratory and the National Bureau of Standards have been using ordinary paper-making machines to produce glass-fibre paper in sheets of 0·01 to 0·014in thickness. This material is not only claimed to be a superior filter of oil, gases, chemicals and micro-organisms, but is also said to be a good dielectric. Indeed a capacitor insulated with it is said to have withstood more than 200 deg C—about twice the maximum allowable for capacitors of the oil-impregnated kraft paper type.

RURAL DISTRIBUTION

It is impossible not to sympathize with the aims of the Council for the Preservation of Rural England in spite of a desire to see rural England enjoying the benefits of electricity. Again in its annual report the Council details its endeavours to secure the placing underground of lines in country districts which possess natural beauty. It contends that the electricity supply industry should generally bear the extra cost which, it says, spread over the whole system would be infinitesimal. That is not the view of the Electricity Boards, which already find rural development expensive, but we believe the Council is going too far when it says that the electricity authorities are determined to "inflict overhead lines upon the country in all circumstances and regardless of the consequences."

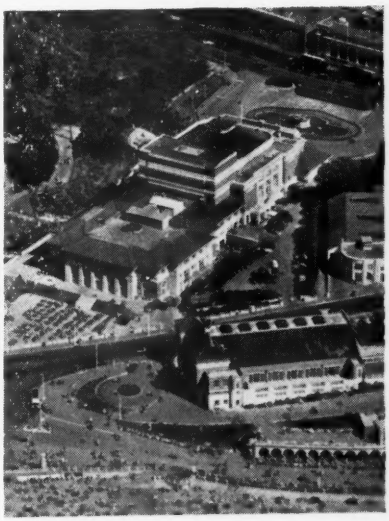
Left: The Town Hall. *Below:* The Pavilion
Photos H. Tempest

Fourth Electrical Power Convention

BRILLIANT weather attended the opening on Monday last of the fourth British Electrical Power Convention. Such weather is essential to the success of any conference of this kind, although it means that the attractions of a place like Bournemouth have to be resisted by those who are really down on business. In spite of such temptations the Town Hall was well filled at the first session (after rather protracted "registration" proceedings) when the Mayor of Bournemouth extended the customary civic welcome. His Worship said that he noticed that special attention was to be given to domestic electricity, and in this connection contended that appliances should be cheapened by the removal of the iniquitous purchase tax which they bore.

After thanking the Mayor and announcing the dispatch of a telegram of loyal greetings to the Queen, Mr. P. V. Hunter, C.B.E., Hon.M.I.E.E., delivered his presidential address. This, together with the Convention papers, is summarized later in this issue.

At the conclusion of the address Lord Citrine (past-president) thanked Mr. Hunter for what he described as a thoughtful, stimulating and challenging address. He noted that neither the trade unions nor nationalized industries had escaped criticism. The subject was one in which there was a large body of doctrine but no agreement. We had had hardly a glimpse of the solution of the employer–employee problem. The President had posed the question of how a large body of men in industry without a voice in its control could have their initiative stimulated. Although there had



been some success, the matter was still in the experimental stage.

Monday afternoon's session was devoted to the papers on electric cooking, heating and water heating by Messrs. J. Y. Sanders, C. H. Smith, J. A. Fraser and Raymond Berry. The authors gave brief reviews of their themes and a discussion followed. Before the discussion the President read a reply to the telegram to Her Majesty.

Dame Caroline Haslett was the opening speaker in a very lively discussion. She regarded the four papers as valuable books of reference and said that they would knit the electrical industry together to meet the attacks made upon it. The term comfort heating used by Mr. Berry was a good one as suggesting that electric heating was not anti-social. Mr. Sanders' remarks on the structure of tariffs was valuable ; he showed that industry could not have cheap electricity unless there was a substantial domestic load. Moreover, efficiency of production depended on the health and happiness of the people in their homes. Dame Caroline underlined the need for more "consumer research" to enable critics to be confounded and to ensure that the industry gave the consumers what they wanted.

People were "customers" not "consumers," said Mr. A. C. Hazel, the next speaker. As one interested in all types of fuel he wanted the customer to have what he wanted. He asked who was the god on high who decreed that a gas radiator should bear a 66 per cent purchase tax, that a paraffin radiator should bear no tax at all and that an electric radiator should pay 100 per cent ? This had no relation whatever to thermal efficiency. He urged the importance of the safety factor and the heat insulation of houses.

The basis of efficiency comparisons was questioned by Mr. O. W. Humphreys, who pointed out that the efficiency of gas production and coal conservation were only incidentally related. The real criterion was how much coal had to be burned to give certain heating results ; the value of by-products was quite a separate matter. For every heating purpose in the home electricity was best. The electrical industry should come off the defensive and refuse to be bullied. There was no reason why gas, coal and electricity should not live harmoniously together in healthy rivalry.

Mr. J. I. Bernard said that the case for domestic electricity had been excellently put by Dame Caroline Haslett at the National Electrical Convention of 1935. Until the last war we had been much in advance of the United States in electric cooking, but subsequently they had gone ahead. That was because there was greater competition here from other methods. He showed that so far as cooking was concerned electricity could do for 10¾cwt of coal what gas required one ton to do. Electricity could save much more good coal for export. Mr. Bernard preferred the thermostatically controlled storage heater to the rapid heating type.

Some electrical retail outlets had not displayed electric heaters in their showrooms for some time, said Mr. J. S. Warren. This was wrong ; customers should be able to see what was available and taught how to use the appliances properly.

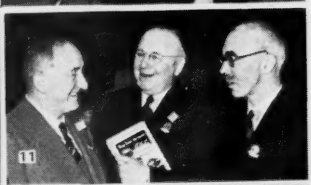
Announcing his intention to take off the "kid gloves," Mr. J. Crogan pilloried several prominent Gas Board spokesmen. The chairman of the Scottish Board, for instance, had recently deplored competition between gas and electricity. What the gas people really deplored was freedom of choice for the consumer and they had persuaded many housing authorities to force people to have gas cooking when many of them wanted to cook electrically. And this was done at a considerable extra cost. The installation of gas meant a waste of steel and coal and curtailed exports.

Miss M. V. Griffith, while commending floor heating, said that portable storage heaters had great scope. Reflective wall surfaces had great advantages. She backed Mr. Sanders' call for more research and regretted that none of the authors had mentioned the heat pump for which the domestic sphere offered opportunities.

Mr. J. F. Field thought that until the electricity supply industry found means of using its waste heat it remained very vulnerable to attack.

Alderman Sir William Walker asked why electrical people should now be "apologists" when for years they had successfully fought their rivals. He spoke of the deleterious effects upon health of gas fumes, quoting a "horrible example" from the United States.

The discussion was wound up by Mr. C. T. Melling, who said that we wanted all the off-peak kilowatts we could get. The industrial load was bound to rise and it must be balanced by an increase in domestic use. We could not expect overseas



1. The President reading his address, flanked by the Council. 2. The Mayor of Bournemouth. 3. Mr. Hunter replies to the Mayor. 4. Lord Citrine, Sir John Hacking and Sir Henry Self. 5. Mr. and Mrs. S. B. Warder and Col. B. H. Leeson. 6. Messrs. V. W. Dale, J. A. Fraser and J. I. Bernard. 7. Sir John Dalton and Mr. V. A. Pask. 8. Messrs. D. Moffat, W. C. Parker and Alderman W. S. Lewis. 9. Mr. W. D. Horsley, Mrs. B. H. Leeson and Mr. E. B. Preston. 10. Messrs. A. B. Goode and A. Kelso. 11. Messrs. H. E. Midgley, E. G. Batt and H. Midgley. 12. Messrs. W. H. Warhurst, R. Lee, I. F. Young and S. S. Scott. 13. Mr. E. R. Wilkinson and Sir Harold Hartley. 14. Dr. and Mrs. J. N. Aldington and Mr. C. A. Hughes. 15. Mr. H. H. Weeks, Mr. P. V. Hunter, Miss H. Hoare, Mr. K. R. Midner and Mr. A. E. Prophet. 16. Mrs. Goodall, Mrs. P. V. Hunter and Mr. S. E. Goodall.

buyers to take our electrical equipment if they saw us using other methods ourselves. The present plant position enabled us to go ahead with domestic development.

Thanking the authors, Mr. S. F. Steward said that everybody in the electrical industry was concerned with the matters raised and they also affected the broad national interest. We had been too successful in the past, but now had to present our case forcefully and with full information.

While the meeting was in progress Mrs. P. V. Hunter was entertaining the lady visitors to tea (with the customary mannequin parade) at the Pavilion ballroom. On Monday evening at the Pavilion concert hall the delegates were received by the Mayor and Mayoress, accompanied by the President and Mrs. Hunter, and a dance followed.

Although the seven papers presented on Tuesday afternoon's fourth session comprised a symposium under the general title of "Research in the Electrical Industry," we feel that Tuesday as a whole may well be regarded as "research day," because so much of the lecture-demonstration "High Performance Dielectrics with special reference to Power Factor Improvement" presented by Dr. R. S. Vincent at the Tuesday morning (third) session was related to research, particularly in regard to the development of new dielectric materials.

We feel that much of the value of Dr. Vincent's paper rested with the manner in which he prepared the mind of his audience in the earlier part of the lecture for what was to come by a refreshing retracing of the scientific developments from the earliest "amber friction" days of Thales of Miletus. This retracing was well illustrated and demonstrated in ways with which most of us are familiar, but with recloaking to give emphasis to the modern accepted electronic theory of electricity: for instance, the attraction and repulsion of metallised paper strip; the "charged air" rotation of the "wind machine"; and Volta's electrophorus.

In developing his line of thought the author outlined the function and modern theory of dielectrics, in connection with which he displayed an ingenious and informative model depicting the physical structure of barium titanate, and then through the general principles of the engineering of dielectrics he went on to deal with types of capacitors (tank and unit), and finally pointed to the potentialities of capacitors by reason of the new dielectrics which were gradually becoming available. A realistic glimpse into the future was afforded by the demonstration of an actual capacitor of normal construction, using magnesium titanate dielectric. This capacitor is only a few inches long, but the capacity is 40 kVA. It handles the electrical load at radio frequency, and the importance is the possibility of getting the capacitor of the same size to handle the same load at power frequency—a promising possibility if the present research trends mature.

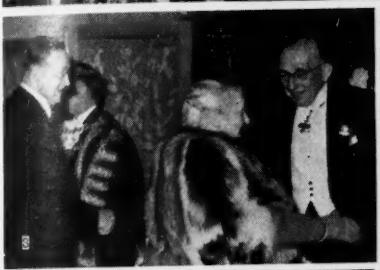
Again in general reference to research we may be permitted to look back to a point in the President's address at the first session on Monday. Mr. Hunter said, in effect, that there are large organizations in America which "sell research." "Selling research" is, of course, not new in this country, although the service is available on a very much smaller scale, but the point we have in mind is that the President's comment referred to and the apparent criticism of American practice, namely, that in the U.S.A. "research institutes served one firm only" in the paper by Sir Arthur Fleming seem to clash in a minor way.

The Dowager Lady Swaythling, president of the Electrical Association for Women, took the chair at the Association's Convention luncheon with her usual charm and humour. After the loyal toasts Mrs. A. T. Dover, B.Sc., chairman of the E.A.W., proposed "The Borough of Bournemouth," saying that the growth of the Association since its foundation in 1924 had been as rapid as that of Bournemouth. The response was by the Mayor of Bournemouth, who after belauding electrical appliances, particularly washing machines, again attacked purchase tax. Incidentally, he said that since he had been chairman of the local Lighting Committee they had changed over about half of Bournemouth's lighting from gas to electricity.

The President of the Convention proposed "Beauty in the Scientific Age." Mr. Hunter spoke of the difficulties of obtaining what one wanted in an artistic sense at the price one was prepared to pay. He said, however, that in the garden much had been done to get beautiful shrubs and flowers.

Mrs. Constance Spry replied to the toast, speaking of the great possibilities of securing beauty in the home by the proper arrangement of flowers.

AT MONDAY EVENING'S RECEPTION AT THE PAVILION



1. The Mayor and Mayoress of Bournemouth with the President and Mrs. Hunter. 2. Mr. Hunter greets Dame Caroline Haslett. 3. Sir John and Lady Hacking. 4. Capt. J. M. Donaldson. 5. Mr. and Mrs. R. Cox. 6. An E.P.E.A. group: Messrs. A. M. F. Palmer, J. E. N. Davis, J. L. Moss, J. F. Wallace and F. Seddon. (Seated) Mesdames Palmer, Wallace and Moss. 7. Messrs. W. E. Warrilow and W. J. Bache. 8. An E.C.A. party: Mr. R. H. Sadler, Mr. V. Ferens, Mrs. Wallis, Mrs. Sadler and Mr. P. G. Wallis. 9. Mr. and Mrs. N. F. Gadsdon.

We regard the symposium of the fourth session as a highly creditable achievement, including the discussion. Most of the seven speakers in the discussion paid high tribute to the authors, e.g., Dr. Dunsheath said he could not remember another occasion when so much information was crowded into so short a time, and he had great admiration for the way the authors had done this.

All the same, the whole thing was cut too fine. The restriction of 15 minutes did not permit each author to give an adequate summary of his paper, and in this connection we endorse Sir John Hacking's comments when he wound up the session. He thought the authors were the victims of a little injustice in view of the great amount of time they must have put into the preparation of their papers.

More's the pity because we doubt very much if ever before so much team work had been put into any symposium at any similar convention in this country, and largely because of this we think that in the long run the papers will prove to be a remarkable contribution to the "learned" literature of the electrical industry.

So far as the presentation was concerned we feel that the authors' use of illustrations and demonstrations by way of slide, film, model and working and measuring apparatus was equally remarkable, and this was especially so in the case of Dr. Aldington's paper relating to the electric lamp industry. It seemed that his very words actuated the controls of the appropriate display, and he did not turn to point or indicate in any way.

He certainly had a popular "pull when he made his plea to "help people to see with greater ease and greater speed" in what one speaker termed as his romantic story.

That some small duplication took place in the papers is not surprising in view of the comprehensive nature of the whole field, but we feel that an observation (certainly not criticism) on this score is not unprofitable. For instance, Dr. Wilkinson referred to the increased breaking capacity and reduced arcing times by the introduction of the side-vented arcing chamber, while Dr. Whitehead explained how the cooling properties of oil were made use of in the side blast baffle switch with several lateral passages allowing rapid escape of hydrogen and oil vapours.

In connection with Dr. Wilkinson's comments about the difficulty of machining austenitic steels used for gas turbines, we were a little disappointed not to hear something about the possibilities of precision casting to eliminate machining.

Dr. Wilkinson did not actually present his paper because of illness, and Dr. Blake deputised for him.

Another author, Sir Arthur Fleming, was away from the country on Government business, and Mr. Kendal took his place.

There was very little in the way of definite challenge in the discussion, although Dr. Forrest was told that instead of referring to "lack of reliable information in respect of condenser tubes," he should have said that in no other case was more reliable information available.

There was a mild tussle on the question of the individual and the committee—the origin of inspiration was in the mind of the man and not in the committee, on the one hand; on the other, committee men understood the work when it was published and did not have to be educated.

There was some talk of complacency in regard to switchgear—controlling the faults and leaving the switchgear to break normal currents was what was really wanted.

At the Carlton Hotel in the afternoon Mr. H. Nimmo, chairman of the Southern Electricity Board, and Mr. R. R. B. Brown (deputy chairman) and their ladies gave a tea party to a number of the delegates.

Viscount Swinton, C.B.E. (Chancellor of the Duchy of Lancaster and Minister of

Viscount Swinton with the Convention secretary, Mr. J. W. Simpson.

Materials), was the principal guest at the dinner on Tuesday evening and proposed the toast of "The Electrical Industry." In a speech humorous and serious by turn he related the position of industry, and the electrical industry in particular, to the general economy. He said that the comprehensive nature of the Convention justified the comprehensive toast. Referring to the scarcity of raw materials caused not only by actual lack but by our need to arrive at a balance of exterior payments, Viscount Swinton dealt especially with copper. He said that if the Government had decided to follow the American price the recent increase would have been not

1. Mrs. Hunter and Mrs. Dragnell. 2. Mrs. Hunter, Lady Self and Lady Citrine. 3. Lady Hacking, Lady de Ferranti and Lady Dalton. 4. At Mr. Nimmo's tea-party: Lord and Lady Citrine with Mr. and Mrs. H. Nimmo. 5. Mr. R. A. S. Thwaites, Dr. J. L. Miller and Mr. S. E. Goodall. 6. Messrs. G. F. Falk and E. W. Jones. 7. Messrs. N. V. Castling, H. B. Laine and G. R. A. Carr. 8. Mr. and Mrs. R. R. B. Brown. 9. Messrs. A. Stephens and E. Burgoyne. 10. Messrs. R. Y. Sanders, J. Gogan and A. E. Roots. 11. Dr. J. S. Forrest and Mr. H. G. Penniket.

The top table at Tuesday evening's annual dinner.

£50 but about double that figure. It was due to the spirit of helpfulness shown by the Rhodesian copper producers that the price had been kept down.

Apart from the copper shortage steel, which was very important in power station work, was also scarce. Even if we could get American steel—and pay for it—there would be barely enough for essential needs. Therefore economy in steel was most essential.

On the subject of power stations, the speaker said that it was natural for the British Electricity Authority to want to combine efficiency with agreeable architecture. But it was as unnecessary to make power stations look like cathedrals as it was to make modern cathedrals resemble power stations.

Viscount Swinton praised the electrical industry for its great export achievements. It was particularly gratifying to note the increase in electrical exports to Canada. There was a special value in exported equipment because customers tended to come back to their suppliers with further orders.

He commended the President's wise words in his address on human relationships in industry. In his (the speaker's) view the more the workers knew about a business the less they wanted to control it. Nevertheless they should be acquainted with the facts about their industries.

He emphasized the gravity of the nation's present position, but said that the adverse flow had now almost stopped; we were holding on, but at a precariously low level. We had spent our accumulated wealth and were debtors to the rest of the world. No Government could rectify the position; the duty of ensuring recovery rested upon all.

The President replied to the toast and the only other toast was that of the guests, which Sir Henry Self proposed and to which Sir William Walker replied.

The Convention closed on Wednesday morning with a "forum" and the annual general meeting.

Fuller reports of the discussions and other proceedings will appear in our next issue.

The Government could only tell the whole unvarnished truth and make all its policy subserve the supreme need. Every measure and every executive and administrative act should be subject to the test: Would it make industry and commerce more efficient? Would it encourage enterprise, initiative, hard work, the taking of risks and the undertaking of new ventures?

Viscount Swinton concluded by saying that if he had painted a sombre picture it was not because he was pessimistic but because there was a need for realism and resolution. "All our past proclaims our future. Britain still shall stand."

Left: The President with Viscount Swinton. Right: The Dowager Lady Swaythling, Mr. Hunter, Mrs. Constance Spry and Lord Citrine at the E.A.W. luncheon.

Presidential Address

By P. V. HUNTER, C.B.E., HON. M.I.E.E.

AFTER surveying the scope of previous presidential addresses Mr. Hunter decided to take as his theme the basic organization of industry, dealing with it in the light of long practical experience and with no preconceived theories.

In the nineteenth century, he said, the introduction of steam power and the railway era led to the establishment of large industrial units employing considerable numbers of people and large amounts of capital. There followed the formation of companies—at first with unlimited liability of the shareholders and later to the limited company.

There was much to be said for the old arrangement by which the shareholders had a more intimate interest in the business and the directors were almost invariably large shareholders. Now the shareholders played so little part in the conduct of a company that it would appear that capital could be found by any other method without serious effect, as, for instance, in co-operative societies. That fact had largely contributed to the ease with which some industries had been reorganized on a national basis, coupled with the retention of employees' pension rights.

Large undertakings were, however, by no means the whole of manufacturing industry. Of the 55,000 separate establishments in this country 50,000 had less than 250 personnel. The reason why they continued to exist in the face of the competition of larger concerns was the friendly relations between the owner-managers and the workpeople. This was a vital factor in industry; the widening of the gap between the two parties had been largely responsible for to-day's indifference and apathy.

The nationalized industries were not free from this widened gap. Although numerous committees had been set up in the electricity supply industry to achieve closer co-operation, it was doubtful whether they were really effective. The secret of mutual respect and friendly relationship lay in personal contact and it followed that the local manager must be given greater power of immediate decision in the numerous problems that cropped up.

The President thought that in the larger organizations a sense of community of interests was slowly establishing itself and a revival of the family atmosphere would help enormously to encourage more willing (and therefore more efficient) production. He scouted the idea that greater interest on the part of workers would encourage them to encroach upon the functions of management.

Regarding trade unions, the President contended that the true role of their leaders was to urge the manufacturer to organize the maximum production possible and then induce the management to give the workers their proper share of the proceeds. The goodwill and interest of the workers was a prize worthy of almost any effort.

Income tax upon extra earnings discouraged extra effort. If overtime payments and incentive bonuses were freed from tax the overall production of the country would be increased by at least 10 per cent without any change of personnel or machinery. Taxation of the extra profits would recoup the Chancellor of the Exchequer.

Lessons from America

At present industrial re-equipment plans were being held up by building licences or restrictions on capital expenditure. Faced with these retarding influences could we find anything in American practice to help us overcome our difficulty? The President thought that without adequate electricity supply and capital expenditure on a scale unlikely to be contemplated for many years it would be impossible to adopt American methods. Where it had been possible—as in the South Wales continuous strip mill—the result had been entirely satisfactory. Other

factors contributed to American success, for instance, the enormous home market, the attitude of factory personnel and greater inducement to pursue industrial research. The President particularly mentioned the practice of large independent research organizations to accept contracts on a cost basis, the sponsor company retaining the exclusive rights to the results. This method should more and more meet the needs of British industry with its large number of smaller concerns.

Turning to the Monopolies Commission, the President criticized the form of procedure imposed upon it and stressed the value of trade associations. In his view the practices condemned by the Commission were, in general, healthy and as an alternative to cut-throat competition were ultimately beneficial to the public.

Mr. Hunter concluded by emphasizing the personal nature of the opinions put forward and by expressing his confidence in the future of an industry which was fortunate in the personalities which guided it.

The Domestic Load

Effects Upon the Grid

By R. Y. SANDERS

IN this long paper (60 pp.) Mr. R. Y. Sanders, F.S.S., reviewed the available data regarding the use of electricity for cooking, water heating and " comfort " heating; showed the extent of the development since 1920; and discussed the effects on the loading of the grid system.

The author introduced the subject by showing that although Great Britain had achieved much electrically the effect of two wars had been to cause this country to fall behind some others. He examined the nature of the criticisms of the electricity supply service and then proceeded to trace the growth and nature of the domestic load, paying particular attention to " comfort " heating. Next the use of electricity for heating and water heating in commercial and industrial establishments was touched upon, with special sections on electrode boilers and floor warming.

Mr. R. Y. Sanders is a deputy commercial manager of the B.E.A.

Capital investment in electricity supply was related to the total national capital expenditure; it was 8·1 per cent of the total in 1950, but Mr. Sanders showed that this was largely due to the endeavour to catch up on arrears at a time of high plant prices. The paper proceeded to justify this much criticized expenditure.

The supply industry's price policy was analysed to confute suggestions that this policy was " anti-social " and reasons were given for the forms of tariff adopted, with particular reference to the allocation of " capacity " costs. Mr. Sanders accused the industry's critics of ignoring the effects of diversity. Dealing with the suggestion that the domestic consumer had benefited at the expense of the industrialist, the author showed that the apparently more favourable position of the domestic consumers had been brought about by a great improvement in their load factor. Other criticisms of methods and levels of charging were dealt with.

Next the paper examined the question of thermal efficiency and related matters. It was stressed that the average calorific

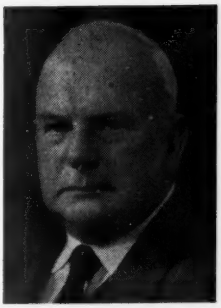
value of the B.E.A.'s coal was only about 11,000 B.Th.U./lb while industry, railways, domestic consumers and the gas industry got coal of a value ranging from 12,500 to 13,500 B.Th.U./lb. Solid fuel appliances needed special fuels and the gas industry coal of high quality. Reference was made to fuel transport costs; the efficiency of combined uses; atmospheric pollution; and labour saving.

Prospective changes in the fields of cooking, water heating and comfort heating were surveyed in the next section of the paper. The "consumer research" already being carried out was mentioned and the need for further investigations was emphasized. The nature of desirable research was set out at the end of the paper as follows: (*a*) The load and habit characteristics of consumers. (*b*) The costs of supply involved for each type of consumer and type of load. (*c*) The fuel consumptions involved in the provision of these services. (*d*) The thermal efficiency of application of electricity through the various consuming appliances. (*e*) In the space heating field, into the possibilities of a radical departure from present methods both of producing comfort heating and of preventing thermal losses from building structures.

Water Heating

By C. HUBERT SMITH

IN a foreword to his paper (presented on behalf of the Electric Water Heater Manufacturers' Association) Mr. C. Hubert Smith, M.I.E.E., M.I.H.V.E., condemned the revival of old arguments against electric water heating as part of a "vicious campaign" against the electricity supply industry. He said that his purpose was to survey the many applications of electricity to domestic water heating which had been proved in long service to be useful to, and welcomed by, the community, and beneficial to the electricity supply industry and the national economy in the utilization of fuel. He proceeded to an introduction in which it was claimed that electric water heating was almost 100 per cent efficient as electricity could be turned into heat energy where and when it was wanted.



Mr. C. H. Smith is managing director of Heatrae, Ltd.

A broad survey of the types of water heater used in the home was made. The most popular type was the "sink heater" of 1½ to 3 gall capacity for giving small quantities of hot water for household purposes. Its average weekly consumption was about 20 kWh. for hot baths and for providing extra amounts of water on wash days a larger heater was required. If a hot water cylinder was already installed, possibly in conjunction with a solid fuel boiler, an immersion heater could provide the occasional hot water required.

Typical thermal storage heaters were illustrated and their construction and operation explained. Attention was then paid to the cistern type water heater which was a complete hot water system in itself and was made in sizes ranging from 5 to 100 gall capacity. Immersion heaters with their thermostats and the methods of installing them were described and then some useful notes were given on cold water supply to heaters.

The factors governing the electrical loading of heaters were discussed and it was stated that from the consumption point of view and the incidence upon the electricity supply system there was little to choose between small capacity with large loading and large capacity with small loading. There followed a section on the setting of thermostats which had a strong influence on heat losses. This was among the factors considered in connection with hard water and the author suggested other means of combating trouble from that cause. Suitable means of providing hot water in flats in small and large blocks were described and illustrated diagrammatically.

Referring to dual-purpose heating equipment, the author said that the fire-back boiler was unsatisfactory. An independent

boiler in the kitchen was effective in space heating and for heating a storage cylinder in the winter months but the overall efficiency was greatly increased by the use of a supplementary electric thermal storage or immersion heater. Next the paper dealt with electric water heating for shower baths, wash fountains, wash basins, etc., and sections followed on the conversion of existing hot water installations to electric heating and the use of electricity as a supplementary means of water heating. Hot water night storage systems formed the subject of the next part and the paper ended with brief notes on the use of electricity for water heating in hazardous positions.

Mr. Smith, in conclusion, contended that the electric water heater, properly applied, was the best of all current-using devices in terms of units consumed in relation to incidence on peak load. It offered unique facilities, by suitable control, for improving the load factor and levelling the load curve. It gave a valuable and much appreciated public service and would endure.

Electric Cooking

By J. A. FRASER

MR. J. A. FRASER'S aim, in a paper presented on behalf of the B.E.A.M.A., was to show the advantages of the domestic electric cooker from the consumer's and the supply authority's points of view. He recalled that even forty years ago those advantages were recognized and he enumerated them under a number of headings. The list included instant availability, silent operation, easy regulation, freedom from combustion products, etc. In connection with the last-named the author showed that an electric cooker needed no means of exhausting fumes and the absence of fumes carried with it many other advantages.

As regarded control he mentioned thermostatic oven control, close regulation of hotplate heat and combined synchronous clock and electric process timer. The possibility of employing electric lamps for various purposes was referred to. Cleanliness and ease of cleaning were stressed and the views of a "prominent Gas Board official" on the subject were quoted commending this quality.

Mr. J. A. Fraser is sales manager, Domestic Appliances Division, English Electric Co., Ltd.

The consistency of results obtained and the economy in cost of operation were other salient features of electric cooking; the Gas Board official was again quoted as conceding "a slight advantage in favour of the electric cooker in running costs." Mr. Fraser considered that if the more likely basis of 14 kWh=1 therm were taken, instead of 20 kWh=1 therm, the advantage was more than "slight" and more should be made of it.

The desire of people to be given facilities for electric cooking was shown in extracts from a publication of the Scottish Housing Advisory Committee and a memorandum by the Standing Joint Committee of Working Women's Organizations (1943).

In 1946–47 the production of gas cookers was twice that of electric cookers; the ratio had since reached three or four to one. It appeared that in 1950 the electric cooker industry produced 260,000 cookers for the home market against 860,000 produced by the gas industry. In the early post-war years the electric cooker manufacturers were pressed by the Government to lay out cooker production to meet anticipated demands for home and export at a minimum of 500,000 a year. During 1946–47 the production did increase to conform with the expected rate of flow but in 1948 the output was reduced by about 50 per cent.

This was due partly to the non-development of the housing programme and partly to the lack of generating capacity. The latter reason was made the excuse for regarding the domestic consumer as a

"rather troublesome child" and other fuel interests took advantage of this. The domestic consumer had been made a scapegoat and was now hesitant about the use of electricity for cooking. Replies to the wide and forceful propaganda by the gas and solid fuel industries had been practically non-existent. The industry suffered from the lack of a spokesman to give a true interpretation of facts and place the electric cooker and its value to the electricity supply interest in its true perspective. What was being lost in cooker load would not be easily regained. Mr. Fraser maintained that such a load was of vital interest and a necessity to the supply industry.

Domestic Electric Heating

By RAYMOND BERRY

THIS paper by Mr. Raymond Berry (presented on behalf of the B.E.A.M.A.), was a very thorough study of domestic heating requirements (primarily for a small home) and the methods of satisfying them. In dealing with the necessity for ensuring that coal was economically used for heating the author said that coal conservation was not the only consideration, although the most important. He also pointed out that in this country's climatic conditions the heating problem was not merely a winter one. When it was required to provide heat as and where it was wanted, the best and cheapest method required the aid of electricity. But in present conditions all-electric house heating could not be advocated.

Space heating, radiant heating and "comfort conditions" were considered and the ideal arrangement was said to be one in which air heating and radiant heating were correctly balanced. Means of providing "background" heating were briefly covered, the electrical methods including air heaters, convectors, low-temperature radiators and tubular heaters. Radiant heating by coal, gas and electricity (electric fires) was then touched upon.

A study of coal fires and other solid-fuel burning media was followed by a review of electrical heating appliances to show that, taking all relevant factors into account, electrical methods had many advantages in the way of effectiveness, adaptability, control and cleanliness.

These aspects must be considered in conjunction with comparisons of thermal efficiency. Such comparisons were made in a series of tables which also gave relative costs of heating by coal and coke, electricity and gas. From these tables it could be gathered that the use of electricity for heating became more advantageous as the period of use shortened or when the heat input to a room was reduced, as was desirable in milder weather. For intermittent heating electricity had measurable economic advantages over solid fuel. An advantage over gas heating also existed, if not so marked, and the choice between gas and electric fires should be left to the public, as the Simon Committee recommended.

While solid-fuel methods were recognized to be desirable for continuous heating, Mr. Berry showed that the flexibility and controllability of electric space heaters improved their economic performance over predetermined periods.

A heating plan for the average home was given in which the use of a solid-fuel domestic boiler was assumed. Arrangements for the various rooms were set out, with reasons for adopting particular methods.

Mr. Raymond Berry is chairman and managing director of Berry's Electric, Ltd.

There followed a brief consideration of the effect of electric heating on the national load factor and curves were reproduced to illustrate the probable daily domestic heating load in winter and in spring and autumn following the adoption of the heating arrangements suggested in the previous section. It was estimated that the heaviest demand would occur outside normal industrial working hours.

The author thought that, as in the foreseeable future it might be the task of electricity to provide all domestic heating to preserve our dwindling coal resources, it would be wrong to commit the nation to a solid-fuel programme, involving extra building costs and special appliances, which might be difficult to reverse.

Lecture-Demonstration

High Performance Dielectrics

By Dr. R. S. VINCENT

THE lecture-demonstration on "High Performance Dielectrics with special reference to Power Factor Correction Capacitors," by Mr. R. S. Vincent, Ph.D., M.I.E.E., F.Inst.P., commenced historically and some of the early experiments in electrostatics were reproduced in order to explain and illustrate the behaviour and function of dielectrics.

Turning to modern theories, the speaker explained that a dielectric was a substance which would store electrical energy reversibly by a physical "mechanism" and when it held its charge it did so by becoming polarized. Such polarization might be electronic, molecular, or atomic. It was explained how the stored charge might be used for the correction of power factor and the qualities governing the practical use of dielectrics in power capacitors were examined.

Dr. R. S. Vincent is research director of British Dielectric Research, Ltd.

Design details and methods of manufacturing power capacitors were given in respect of (*a*) the tank type, for long life and low running costs; (*b*) the unit type, for reduction of initial cost, volume and weight at the expense of slightly greater loss and shorter life.

Impregnated paper as a dielectric was dealt with and the speaker drew attention to a number of interesting dielectrics which would gradually become available but had not yet been applied in this country, except perhaps experimentally. Some of these substances were thought likely to lead, within the next few years, to new developments in the power capacitor field.

Polystyrene was now obtainable as a thin film with a high dielectric strength and extremely small loss. Some of the titanate ceramics had permittivities at 50 c/s of 3,000 or even more, and barium/lead zirconate had a permittivity of 6,000. In most cases, however, these materials had physical, mechanical or economic limitations which must be taken into account.

Recently a new chemical plant in Monmouthshire began producing chlorinated diphenyls and polyphenyls which were of greatest interest to makers of capacitors and transformers. Tetrachlordiphenyl had a permittivity of about 5·6 so that its use as an impregnant increased overall permittivity of impregnated paper by from 50 to 100 per cent in comparison with oil. Much work had been done at the E.R.A. and elsewhere on the addition of stabilizers to chlorinated impregnants and it now seemed probable that the problem of chemical instability had been solved.

It had not yet been decided whether the 30 per cent or so saving of capacitor volume justified the extra cost of the chlorinated impregnants and the greater care necessary in manufacture. The chief argument advanced in their favour was the lessened

fire risk. These various problems would be resolved only after further research and experience and in the meantime newer impregnants might be found.

Polystyrene film was now available commercially in various thicknesses down to ½ mil and was already used in the manufacture of radio capacitors. It was not possible in practice to obtain the full advantage of its great intrinsic strength because of the presence in the polystyrene foil of occasional conducting particles and weak places. Generally, therefore, it was preferable to break up the dielectric layer into separate foils. Before unit type power capacitors using polystyrene dielectric could be manufactured, considerable practical difficulties and perhaps research problems had to be overcome.

Barium titanate unfortunately had at 50 c/s a dielectric loss at room temperature about seven times as great as that of oil-impregnated paper. The consequential generation of heat would involve expensive and complicated cooling arrangements, increasing size and cost.

Two promising materials were the mixed titanates of barium and strontium and a newer discovery of mixed zirconate of barium and lead. On the assumption that a suitable ceramic would become available in commercial quantities it would be possible to design a unit power capacitor of about half the size of a paper dielectric equivalent. Work was still in the development stage, but there seemed to be no doubt that in full-scale mass production the price would be competitive.

Research Activities

Electrical Research Survey

SIR ARTHUR FLEMING INTRODUCES SIX PAPERS

A SERIES of papers on research in the electrical industry was introduced on Tuesday by Sir Arthur Fleming, C.B.E., D.Eng., Hon.M.I.E.E., who surveyed the present position as it has evolved from the labours of comparatively isolated scientists to the organized co-operative work of to-day. He traced the sequence of operations requisite to develop abstract ideas of scientists, who were concerned to explain natural phenomena (thereby disclosing new knowledge), through the investigations of industrial research scientists, whose function it was to apply new knowledge economically to particular purposes (often entailing the construction of pilot plants) in commercial production. In the past half-century large electrical organizations had set up private laboratories, which reduced the time lag between scientific discoveries and their use by the community. The closest co-operation existed between the electrical and many other industries, e.g., metallurgical, chemical and plastics.

Sir Arthur Fleming is director, research and education, of Associated Electrical Industries, Ltd.

Research organizations could be classified as: universities and technical colleges for fundamental research; research departments; development departments of large manufacturing concerns; co-operative research associations, especially the E.R.A.; research in operating concerns such as the Post Office and B.E.A. Cumulative savings might be effected by improving the material used in a single member of a mechanical system, thus enabling dimensions of that and other members to be substantially reduced.

In co-operative research Great Britain was far ahead of other countries, e.g., the United

States, where research institutes served one firm only, leading to duplication and waste of scientific man power. A valuable function of research associations was to provide facilities for smaller firms without laboratories. A major limitation to getting new knowledge and ensuring its use was trained scientific personnel.

Research Associations

By Dr. S. WHITEHEAD

THE place of co-operative research was dealt with by Mr. S. Whitehead, M.A., D.Sc., M.I.E.E., F.Inst.P., who, after referring to the activities of universities, technical colleges and trade associations within and without the electrical industry, discussed the work of the Electrical Research Association, which was formed in 1917 from the research committees of the Institution of Electrical Engineers and the British Electrical and Allied Manufacturers' Association, and is now, with an annual income of £250,000, one of the country's seven largest research associations.

Taking the relevant turnover of the whole electrical industry as £1,000 million, the cost of research and development, he said, probably exceeded one per cent and of research alone ½ per cent; the total amount spent was probably as great as could be readily justified. The income of E.R.A., however, was only 0·025 per cent of the industry's turnover, or 5 per cent of the total research expenditure, to which it had declined from over 10 per cent. The present proportion was too low, even though most research must be associated with individual production and operation.

At present one-third of the income came from electricity supply, less than one-third from the D.S.I.R., less than one-quarter from manufacturers and less than one-tenth from Government Departments. The E.R.A. did not serve manufacturers of domestic radio and television sets or telecommunications which concerned the Post Office, B.B.C. and Radio Research Board; the support of electrical contractors was slight, though they made use of the Association's work in various ways.

The work of the E.R.A. fell under the following main headings: long-term development; co-operation with other industries (particularly with regard to supply of materials); co-ordination between sections of the electrical industry; consumer problems; fundamental research; and speculative projects.

Switchgear provided the outstanding example of development research. Experiments by E.R.A. with the aid of the Wedmore high-speed camera had established the principle of keeping the arc as short as possible and imprisoning it on the up-stream side within the high velocity region of the escaping blast, which principle was widely used in modern air-blast switchgear. Cooling properties of oil were made use of in the side-blast baffle switch, which imprisoned the arc and oil in a small enclosure with several lateral passages starting close to the arc path and allowed rapid escape of hydrogen and oil vapour across points in the length of the arc. Arc control pots definitely based on E.R.A. patents and now in commercial use aggregated 1·5 million MVA of breaking capacity up to the highest ratings and voltages. Basic work on re-ignition or extinction included studies of stresses imposed on arc gaps through rate of rise of re-striking voltage and of the way in which the arc gaps near zero current would withstand these stresses when extinguishing the arc.

Dr. S. Whitehead is director of the Electrical Research Association

Reports on the distribution of surge voltages in transformer windings had led to important developments. The E.R.A.

surge ...ter was successful in reducing both ampli...de and steepness of surges. Lightning r...earch, with the co-operation of the B.E.A. and Area Boards, was expected to lead s...rtly to an economic design of lines and p...tective gear, based on a compromise betwe... cost and probability of the hazard. Trans...rmer noise as affected by magnetostricti... and by joints, for both hot-rolled and c...ld-rolled steels, was again under investi...ation. The life of capacitors with chlori...ated impregnants had been prolonged from five- to thirty-fold. Among numerous other studies that had led to practical results were the discovery of new permanent magnet alloys and the investigation of the heating of lamp fittings and connecting cables.

An example of basic information studies was the determination of standard ratings for cables and overhead lines by fixing limiting temperatures of materials and heat absorption and transmission by surroundings, with factors to cover variations of environment, cyclic loading and short peak loads. The N.P.L. had amassed for the E.R.A. a record of the electrical properties of the most important dielectrics over the widest ranges of humidity, temperature and frequency. Tables of thermodynamic properties of steam were being extended to 14,000 deg F and 6,000 lb/sq in.

As a long-term development bulk transmission by d.c. at high voltages had been worked out on model scale, which had led to the invention of refined methods of control. Wind surveys had provided quick and cheap methods of site selection for windmills. Two important instances of co-operation with other industries related to electrical insulation and creep tests for steels suitable for high temperatures and pressures.

In fundamental research the greatest successes were concerned with breakdowns of materials, which could be classified as electronic, thermal, discharge or electrochemical and the last three could now be successfully applied to industrial problems. Other activities had been connected with magnetic properties and discharge phenomena. The most striking of the speculative researches was probably that relating to the "fuel-cell," the direct conversion of electrochemical into electrical energy; investigations were being undertaken to ascertain whether the difficulties encountered could be readily overcome.

Electricity Supply Research

By Dr. J. S. FORREST

APPLIED research carried out by the British Electricity Authority at Leatherhead, Croydon, Grove Road, power station laboratories and at outside centres was described by Mr. J. S. Forrest, M.A., D.Sc., M.I.E.E., F.Inst.P., who first discussed steps taken to improve boiler availability by reducing formation of bonded deposits on heating surfaces. Lowering of temperatures of the fuel bed in stoker firing and of the furnace in both stoker and pulverized fuel firing by increasing moisture content of combustion air or by re-circulating some of the gases had been very successful. A statistical investigation of internal corrosion in 600 boilers was in hand. The efficacy of ultrasonic methods of detecting caustic cracking at rivet holes was being studied. A very substantial reduction in moisture precipitation from thirty cooling towers had been obtained by providing them with a new kind of spray eliminator.

Dr. J. S. Forrest is director of laboratories, B.E.A.

Apart from researches in connection with higher steam pressures and temperatures and the use of steam generating units of larger capacity, a recently proposed heat cycle involved the use of steam as a working fluid in a gas turbine. Success would depend upon such factors as efficiency of a compressor operating on steam and its freedom from blade erosion by wet steam; a pilot plant, consisting of a 11,000 r.p.m. compressor gear-driven by a 2,000 h.p. motor had been built for testing potentialities of this system. The possibilities

of installing at collieries gas turbines fired with methane or gas from underground gasification or, possibly, with coal were under consideration.

As a result of work done at Croydon the mechanism of insulator flashover in polluted atmospheres was elucidated and apparatus devised for measuring irregular performance of insulators. Service trials were in progress of weather resisting glaze which would permit a stabilizing current of from 0·5 to 1·0 milliamperes to flow through the insulator.

Lightning was responsible for about 40 per cent of breakdowns on the grid. Impulse characteristics of insulators, plant and protective devices were being studied with the help of a 1,400 kV impulse generator at Leatherhead. Radio methods were employed to record atmospherics from lightning flashes, and control engineers were informed of outbreaks and severity of of thunderstorms in their areas. Surge recorders at various points in the system provided data of the number and magnitude of surges from all causes. Study of effects of weather on the load (e.g., an increase of 1 per cent per deg F of sudden drop in temperature) assisted control engineers in forecasting plant capacity required on the next day.

Corrosion of s.c.a. conductors in some industrial and coastal districts, which once necessitated replacement after five years, was cured by impregnation and coating with grease. For controlling the condition of insulating oils in transformers and switchgear, a d.c. conductivity test had been devised and the use of anti-oxidants and chlorinated diphenyl was being studied. In addition to a large number of other operation matters dealt with, there were the researches connected with the 275 kV grid, especially those relating to corona losses and radio noise.

Other researches mentioned related to condenser tube corrosion, flue dust measurement, district heating, turbine vibration, rotor "copper-shortening," wind generators, space heating, overhead line joints, transformer noise, underground cables and communications. In many of these the British Electricity Authority worked in co-operation with research associations and universities.

Research by Manufacturers

By Dr. K. J. R. WILKINSON

IN introducing his subject of the nature of research in the electrical manufacturing industry, Mr. K. J. R. Wilkinson, D.Sc., M.I.E.E., pointed out that, with the possible exception of the chemical industry, there was no field where such a diversity of problems had to be faced. Metal cutting, for instance, was receiving intensive study. High-temperature alloys, as used in gas turbines, were difficult to machine but heating them to 800 deg C greatly increased the tool life and metal removal rate. Greatly increased tool life could also be obtained by altering cutting tool angles. Silicon steel strip could be cold-rolled to give lower hysteresis losses at high flux densities than when hot-rolled, depending upon the degree of orientation of the crystal structure, but further research was essential before conditions for producing cold-rolled strip could be specified with certainty.

Dr. K. J. R. Wilkinson is chief assistant to the director of research, British Thomson-Houston Co., Ltd.

After considering the feasibility of arriving at a common basis for machine design and the contribution made by the network analyser to an understanding of the complex factors involved in maintaining stability of an electrical system, the author discussed the study of transients, with especial reference to re-striking voltages and interruption at near current zero.

The larger and more rapid changes in

temperature of the rotor of a steam turbine operated at high steam conditions, as compared with its more massive cylinders, during starting up and shutting down, were measured by instruments which showed both differential axial movement of the shaft and casing and any eccentricity of the shaft itself. Instruments indicated the shaft movements by electrical quantities derived from changes in reluctance of magnetic air gaps. A novel a.c. bridge circuit had been developed for determining the value of the loss angle of charging current as a measure of the state of the major insulation to earth of a bank of three single-phase potential transformers.

Manufacture of gas turbines was made difficult by the need to use low-creep austenitic steels in view of the high working temperatures. These steels were not easily machined or forged and rotors must be welded together from small pieces. The possibility was being explored of finding new steels containing high proportions of refractory materials or, alternatively, making sintered mixtures of refractory ceramic with creep resistance and a bonding material that imparted toughness and thermal shock resistance. A third possibility was to employ metals with good mechanical properties at high temperatures but prone to oxidization, which could be guarded against by a protective coating of silicides. Corrosive products in the fuel ash, tending to slag at operating temperature, might perhaps be met by enamelling or providing other coating for the blades.

Organic insulations were generally unsuitable for temperatures above 130 deg C but organic compounds in which some of the carbon was replaced by silicon, were serviceable at 180 deg C. The important characteristic of polyester resins was that they contained no solvent and gave off no volatile matter when cured; hence their attractiveness for making coils moisture proof and corona proof at high altitudes and for impregnating contactor coils to improve thermal dissipation.

The introduction in the 1920's of the side-vented arcing chamber for switchgear materially raised breaking capacity and reduced arcing times. A progressive lightening of springs and moving parts followed. The recent addition of a resistance shunting each of the two main portions of a double contact break enabled the severity of restriking voltage to be controlled. During the past twenty years the capacity of a breaker of given size had been multiplied three-fold and its total break time reduced to below one-third.

Steam Generation

By W. F. SIMONSON

IN a paper presented on behalf of the Water-Tube Boiler Makers' Association, Mr. W. F. Simonson, B.Sc.(Eng.), A.C.G.I., M.I.Mech.E., indicated the chief investigations in relation to the design of modern steam boilers. Adoption of higher steam pressure and temperatures had, he said, revealed anomalies in the existing steam tables; experimental determinations were needed up to the critical pressure and for the flow of water during change from the liquid to the gaseous state under the influence of heat transfer. With advancing steam pressures, scaling and metal corrosion became more critical; at the associated higher temperatures the volatilization of dissolved substances, resulting in deposits on the turbine blades, called for increasingly accurate control of water conditioning.

Mr. W. F. Simonson is technical officer, Water-Tube Boilermakers' Association

Constructional features under constant review included: creep characteristics and resistance to scaling and oxidation of carbon and alloy steels; protection against the corrosive effects of products of combustion and of ash at furnace temperatures; welding techniques appropriate to the type and thickness of drums, headers, tubes and pipework connections; non-destructive testing by X-rays and ultrasonic methods.

Increased superheater duty at higher

temperatures entailed fuller use of radiant heat transfer. Radiation from luminous flames containing carbon particles were now being studied experimentally. Simple assumptions of the chemical reactions of combustion had been found inadequate to establish scientifically accurate heat balance data and only work on large operating boilers would meet the requirements.

Since a 100 MW unit boiler consumed about 15 cwt of coal a minute, fractional percentages of deleterious constituents in the ash became of serious significance in bulk. Sulphur, phosphorus and chlorine were the subjects of recommendations regarding the allocation of coals to types of boilers most capable of dealing with them, but the effects of traces of iron, vanadium and boron when volatilized from the ash still required investigation. Ash softening and fusion temperatures needed to be predictable when designing for the high furnace temperatures requisite to achieve high superheat. The influences of moisture content and sizing of coal upon flow characteristics and grindability on mill performance were also important. High and low temperature deposits on exterior surfaces, due largely to sulphur dioxide and its oxidation to trioxide, were being investigated at power stations.

Fundamental physical research was needed to obtain information upon the viscosity and conductivity of gas mixtures, as these values could not be derived from the properties of the separate gases. Heat balance calculations could not be based upon specific heat data alone. Thus a gain of heat in the passage of flue gases over air preheaters was explainable only by the continued oxidation of the constituents of the gas mixture at comparatively low temperatures. The presence of methane below the threshold values of the Haldane measuring apparatus could account for observed discrepancies and infra-red analysis was to be made of representative gas samples from plants in service.

Unlike other power station plant, boilers could not be tested for operational characteristics at the makers' works. Major investigations had to be done at power stations, so that problems arising from fuel diversity could be fully studied.

Advances made owed much to the stimulus of technical competition among individuals and manufacturers in combination and co-operation with fundamental and applied research bodies at home and abroad.

Power Cables

By E. L. DAVEY

THE technical background to high voltage cable research, Mr. E. L. Davey, B.Sc.(Eng.), M.I.E.E., stated in a C.M.A. sponsored paper, was generally speaking that the overall dimensions of a cable increased as an exponential function of voltage/electric stress for a given conductor diameter; hence at each voltage step there was an urge for a greater stress value. Thus, 132 kV cables (in 1932) to be of an economic size, called for much higher stressing than before. This led to the development of the oil-filled, compression, gas-filled, impregnated-pressure and gas-cushion types which were now being designed for 275 kV. These cables were the results of work carried out in 25 separate departments of C.M.A. members, where over 1,000 persons were employed on research and development. Annual expenditure on this work was about £1 million and represented a higher amount per firm than for British industry as a whole.

Mr. E. L. Davey is chief engineer of W. T. Glover & Co., Ltd.

As a result of copper stringency, attention was being given to stranded aluminium conductors and soldered joints for connecting them to accessories, trials of compression joints not having proved successful. Other jointing methods, e.g.,

welding and brazing, were being considered. Where the amount of power to be transmitted at very high voltages was small the conductors having the large diameters necessitated by electrical stress might have to be hollow. The possibilities of using oils and gases to give results superior to those now attained were being investigated. Development of plastic or synthetic dielectrics with low permittivity, power factor, losses and charging kVA and high surge strength presented another line of research.

At higher temperatures and also for voltages of 220 kV and upwards, avoidance of thermal instability had to be dealt with. Dielectric losses were some 30 per cent of the total. As regarded screening of conductor surfaces for high voltage cables, much work had been carried out in detecting the onset of ionization.

Mr. Davey specified the methods of applying aluminium sheaths as: drawing the insulated cable into tube, which was subsequently drawn down to fit the cable; applying aluminium strip and then bonding it round the cable and welding along a seam; and direct extrusion.

In connection with proposals to lay high voltage submarine cables between this country and the Continent, the manufacture and jointing of very long lengths of cable was under consideration.

The voltage and dielectric stress in d.c. cables were resistance distributed instead of capacitance distributed. Variation of the former with respect to temperature was much greater and might result in complete redistribution of stress in the dielectric when a temperature gradient existed from the conductor to the sheath. This problem involved a good deal of research into resistance of various dielectrics in relation to temperature. Other researches were on anti-corrosive coverings, tests on complete cable installations, and on accessories.

Electric Lamps

By Dr. J. N. ALDINGTON

IN the first part of his paper on the influence of research on the electric lamp industry, Mr. J. N. Aldington, B.Sc., Ph.D., F.Inst.P., F.I.E.S., A.M.I.E.E., dealt with the historical aspects of his subject. In the second part he described the major developments over the past twenty years or so. Starting with raw materials he referred to the many kinds of "glass" required as envelopes for the various light sources and the wide range of temperatures over which their expansion coefficients must be equal to that of the metals sealed to them.

Dr. J. N. Aldington is director of research and deputy works manager, Siemens Electric Lamps & Supplies, Ltd.

One instance of research results was the production of glass refractory enough to withstand deformation when heated by a mercury vapour arc blown upward by convention currents in a lamp operated horizontally. For sodium lamps a new glass that would not be attacked by sodium vapour was produced, but it was liable to damage by moisture, so an outer envelope that was not susceptible to atmospheric conditions, but with similar expansion characteristics, had to be developed.

Tungsten was the most refractory of all metals and its use for filaments led to powder metallurgy. Similar contributions to metallurgical processes were made by the industry with regard to molybdenum, used for filament supports and other purposes. A notable British contribution to the development of fluorescent lighting had been the production of calcium halophosphate powders giving a very wide range of colours; research into other phosphors was also being carried out. While developments with mixed powders between 1940 and 1944 improved efficiencies from 32 to 38 lumens/watt at 100 hours, the progress with halo-phosphate powders between 1946 and 1951 was from 45 to 50 lumens/watt. Lumen maintenance of fluorescent lamps now extended to over 5,000 hours. For quantity production the physical limit was now 80 W and it seemed unlikely to exceed 150 W; below 10 W, the efficiency fell materially.

Hydrogen was largely used either alone or with three times its volume of nitrogen

(which still formed a proportion of gas in gasfilled lamps) in a variety of heat treatment and welding processes, and for providing a reducing atmosphere during investigations on and in the production of tungsten and molybdenum. The main function of oxygen was the production of high temperature flames with coal gas or hydrogen. Argon was now the principal constituent of the gas in gasfilled incandescent lamps; it possessed a low thermal conductivity, although higher than that of the rarer krypton used in small miners' lamps, which gave up to 20 per cent greater light output.

The ultra-violet lines in the neon spectrum were now used to excite fluorescent coatings and, due to British pre-war research, pink and yellow discharge tubes employed neon with calcium tungstate. The hot-cathode neon floodlighting lamp furnished another example of rare-gas discharge. The rarest, xenon, was used for the best repeating flash tubes, which gave at will flashes of high intensity light of short duration, and for the rare-gas arc, which produced a practically continuous neon-daylight spectrum.

Automatic high speed machinery and advanced high vacuum techniques were notable features of lamp manufacture, in which statistical quality control enabled not only the physical aspects but also the performance characteristics of lamps to be maintained at each stage of the process.

Transmission Line Reactances

Simplification of Equations

By A. N. BRIGHTON, B.SC., A.M.I.E.E.

CALCULATION of inductive reactance and shunt capacitive reactance for transmission lines can be simplified by altering the form of the equations that were published some twenty years ago by the leading British cable manufacturers and others. Although the inductive reactance equations are based on fundamental theory, empirical constants have been introduced to account for the various stranding arrangements that are used for transmission line conductors. For example the inductance L of a transmission line with non-magnetic conductors is given by the formula $(K + 0{\cdot}741 \log_{10} D/r)\ 10^{-3}$ henries per conductor per mile.....(1) where D is the equivalent distance between conductors, r is the conductor radius in the same units as D, K is the empirical stranding constant, values of which are quoted in Table 1. It should be noted that $D = \sqrt[3]{abc}$, where a, b and c are the distances between the conductors of a three-phase line. The reactance X would then be

$$2\pi f 10^{-3} (K + 0{\cdot}741 \log_{10} D/r)$$

that is $X = 0{\cdot}004656\ f \left(\frac{K}{{\cdot}741} + \log_{10} 1/r + \log_{10} D \right)$ ohms/conductor/mile .....(2)

In this form it will be noted that equation (2) gives the reactance X as the sum of three separate reactances. Now two of these depend on the type and size of the conductor while the third term is dependent only upon the separating distance; consequently the equation can be split up into two convenient parts:—

$$x_a = 0{\cdot}2328 \left(\frac{K}{{\cdot}741} + \log_{10} 1/r \right) \text{ohms/mile}$$

at 50 c/s when conductor is erected at 1ft spacing.....(3)

TABLE No. 1

Number of strands in conductor	Constant K for calculating L by equation (1)	Constant K′ for calculating GMR to use in equation (6)
"solid"	0·0805	0·7787
61	0·0840	0·7703
37	0·0850	0·7678
19	0·0890	0·7584
7	0·1021	0·7281
3	0·1200	0·6889

$x_d = 0{\cdot}2328 \log_{10} D$ ohms/mile at 50 c/s for spacings at D ft.....(4)

The sum of x_a and x_d will give the required reactance X, the same as solving equation (2); x_a however can be simplified by introducing a new constant K′ that will replace the old constant K.

Rewriting equation (3) for this new constant we have:—

$$x_a = 0{\cdot}2328 \left(\frac{K}{{\cdot}741} + \log_{10} 1/r\right)$$

$$= 0{\cdot}2328 \log_{10} 1/K'r$$

then by equating dissimilar terms we get:—

$$K/{\cdot}741 + \log_{10} 1/r = \log_{10} 1/K'r$$

$$\therefore K/{\cdot}741 = \log_{10} 1/K'$$

$$\therefore \text{antilog } K/{\cdot}741 = 1/K' \quad \ldots\ldots(5)$$

Equation (5) now enables values of the constant K′ to be calculated for each of the quoted values of K and permits equation (3) to be re-written as

$$x_a = 0{\cdot}2328 \log_{10} \frac{1}{GMR} \quad \ldots\text{.ohms/mile at 50 c/s}\ldots\ldots\ldots\ldots\ldots(6)$$

where GMR is the geometric mean radius = K′r in feet.

So far as the author is aware, equations (4) and (6) and the quantity GMR have been published only in modern American text-books, but the values of K′ given in Table 1 below have been calculated from equation (5) and can be used to facilitate the calculation of reactances for British Standard sizes of non-magnetic conductors.

Equation (6) can therefore be solved once for each type of conductor and equation (4) solved for a standard range of equivalent spacings. Tables of these two sets of reactance values can then be drawn up and used to give the total reactance for any set of conditions by merely adding the reactances given by the respective tables. The values of x_d, however, for distances below 1ft spacing are negative and must be subtracted from the values of x_a. This concept can be used to advantage when referring to tables that give reactances for various spacings for a range of different conductor sizes; suppose for instance the reactance at 20ft equivalent spacing is required for a certain size of conductor, if this distance is not given, add the reactances given for two distances that are factors of 20, say 4ft and 5ft, and then subtract the reactance at 1ft; the remainder will be the reactance at 20ft.

The new constant K′ presented above (unlike the constant K for formulæ 1, 2 and 3) is not dependent on line length, consequently the quantity GMR has a fixed value for each conductor which is only dependent on the number of strands. The further adjustment of the GMR to account for variations due to magnetic properties, or due to specially shaped conductors such as hollow segmental or twin conductors placed near together is, however, outside the scope of this article.

The formula for shunt capacitive reactance X′ can be treated in a similar manner to the inductive reactance formula, namely

$$X' = \frac{10^6}{2\pi fC} \text{ ohms/conductor/mile.}$$

Where:—f is the frequency in c/s

$$C = \frac{0{\cdot}03883}{\log_{10} D/r} \mu F/\text{mile}$$

and D and r have the same values as in equation (1).

$$\text{Therefore } X' = \frac{\log_{10} D/r}{0{\cdot}03883 \times 2\pi f} \text{ megohms/mile/conductor}$$

$$= \frac{4{\cdot}099}{f} (\log_{10} D + \log_{10} 1/r)$$

$$= x_c + x_d'$$

where $x_c = 0{\cdot}08198 \log_{10} 1/r$ megohms/mile at 50 c/s for conductor radius r ft erected at 1ft spacing..(7)

$$x_d' = 0{\cdot}08198 \log_{10} D \text{ megohms/mile for spacings other than 1ft} \ldots\ldots\ldots(8)$$

Tables for x_c and x_d' can be drawn up, as for the inductive reactances, to give the shunt capacitive reactances for each type of conductor and a standard range of separating distances, the only difference being that these capacitive reactances are inversely proportional to frequency and line length, whereas the inductive reactances are proportional to frequency and line length.

The adoption of this method of recording the x_a and x_c reactance values at 50 c/s would be a most useful addition to conductor tables, provided values are given for specially shaped conductors that render the above formulæ ineffective, and subject of course to the tables being readily available to engineers responsible for planning transmission lines.

New Books

Multi-Motor Traction for Cranes. By R. A. West. Pp. 84; figs. 9; plates III; index. Sir Isaac Pitman & Sons, Ltd., Parker Street, Kingsway, London, W.C.2. Price 21s.

Much of the information in this book was originally intended to form a bulletin for the assistance of technical staff associated with the author in dealing with multi-motor long-travel drives, and would undoubtedly be most useful for this purpose. Mr. West commences by dealing with the electrical and mechanical requirements for taking care of normal and adverse conditions which may be encountered on such drives in practice, together with their effect on motor design. The various types of crane structures are classified for ease of reference and understanding. The application of various methods of multi-motor driving to the main classes of cranes, and safety control, are discussed.

In particular the notes on the operation, characteristics, and applications of pilot selsyns and power selsyns are very interesting and instructive, as are also the practical instructions on synchronizing. Included in the book is a chapter containing an analysis of a power selsyn drive applied to a five ton coal unloader, and two appendices with very useful formulæ and their applications.

The special subject of this book may be new to many electrical and mechanical engineers who have not been concerned with the particular problem of mechanical linking of motor drives, but the theme is an interesting one and may suggest to some engineers other applications of the various systems. This book will form a useful companion to the author's book on electric traction for cranes.—J.L.W.

Fundamentals of Technical Electricity. By H. G. Mitchell, M.A., B.Sc. Pp. 543; figs. and index. Methuen & Co., Ltd., 36, Essex Street, London, W.C.2. Price 18s.

It is always a difficult matter to decide exactly where the dividing line between pure and applied science lies; there can, however, be no question but that a knowledge of the former is always helpful when studying the latter. In this excellent book the author has given a reasoned survey not only of the many different applications of electricity, all of which may be grouped under the comprehensive title of technical electricity, but also a careful study of the fundamental principles which have led to the development of these applications.

This compels a rather unusual order of treatment in which, for example, the preliminary discussion on atoms and electrons reveals the link between electricity and chemical action and, later on, the study of the fundamental idea of electrical conduction leads to a survey of the principles of the cathode ray tube. It will be appreciated that this method of treatment is of necessity rather more lengthy as indicated by the 543 pages required to cover the normal syllabus of the examinations in electrical technology. But the ambitious student who is prepared to read all round his subject rather than confining himself to the bare bones of a syllabus will reap the reward of a fuller understanding of the science and practice of electricity as a whole. The practising engineer should also find the study of this book very well worth while in his search for the improvement of existing techniques and the development of new ones.—A.R.

Television Principles and Practice. By F. J. Camm. Pp. 215; figs. 144; index. George Newnes, Ltd., Tower House, Southampton Street, London, W.C.2. Price 25s.

This well-illustrated and up-to-date book deals with the fundamental principles of television transmission and reception and covers all aspects of the subject, including servicing and installation. It also includes a comprehensive dictionary of television terms. Starting off with a description of the B.B.C. television system, it deals with cameras, explains how the picture gets from the transmitter to the receiver, and describes projection receivers and stereoscopic and colour television. Other topics include time bases, d.c. receivers, interference and advice on adjusting a domestic receiver. The book is likely to be of value to the technician, the student and the amateur.—R.P.

VIEWS on the NEWS

By REFLECTOR

A FEW months ago I attended a most interesting lecture and demonstration on the subject of television by a leading engineer with a prominent radio and electrical manufacturing concern. Among other things, the lecturer showed on a television screen the dreadful mess which a hair dryer made of the picture but he also demonstrated how this could be rectified by the fitting of a suppressor. The other day a friend of mine ordered a hair dryer, with suppressor, from the same company. It arrived without the suppressor and upon raising the point my friend was told that the company had no suitable suppressors and she was advised to get one from another firm. There was also a suggestion that a suppressor was not really necessary.

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A new panoramic view of London from Highgate Hill (a very different view from that seen by Whittington when he " turned again ") appeared in *The Times* the other day. The most prominent recent addition to the scene is the tall square chimney of the new Bankside power station. In the opinion of the newspaper's architectural correspondent, some at least of the misgivings of those who opposed the new station have been justified. Although the shaft is certainly very visible it is hardly " silhouetted against the rising ground in south London," as the caption says. The background tends to make it less conspicuous.

* * *

At an exhibition held by the Association of Public Address Engineers the London correspondent of the *Manchester Guardian* heard a member say (referring to television receivers): " One set has 84 screws to be undone before you get it out of the cabinet." This seems to me to be a particularly bad example, but difficulty of access to the " works " is a common failing of radio and electrical equipment. I suppose it is not wise to make it too easy for the " amateur " to get at the inside of the apparatus or to put it together again but I think that designers sometimes pay no regard to the requirements of the service man. Inaccessibility is often accompanied by too-complicated methods of assembling components.

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Strange discoveries are at times made by some of the Sunday newspapers. For instance, the *Sunday Chronicle* recently reported that:

> " in a locked room in Broadcasting House there stands between the hours of 7.30 and 9 a.m. every day a live microphone into which nobody speaks. This is the fuel warning " mike " used only seven times in the past eight months. Which means that the B.B.C. transmitter on 1,500 metres (normally closed down between 7.30 and 9 a.m.) has been alive at full power and wearing itself out to provide only 3½ minutes of broadcasting . . . in 360 hours. Is such wastage necessary in flaming June? Says the B.B.C.: ' We can't switch off until told to by the Central Electricity Board.' "

As the C.E.B. went out of existence over four years ago it looks to me as though this extraordinary business will go on for ever.

* * *

One hears of the granting of degrees in all kinds of subjects by some American so-called " universities "—doctorates in salesmanship or pugilistics, for instance. With these precedents there was justification for a recent rapid " degree " course arranged by the American General Electric Co. Invitations were issued to electric utilities to send officials to a three-day instruction in street lighting technique and practice. Upon completion of the curriculum the students were awarded the degree of " Doctor of Lumenology." By the beginning of May there were over 6,000 of these " doctors."

PERSONAL and SOCIAL

News of Men and Women of the Industry

THE B.B.C. announces that **Mr. J. P. Broadbent** has been appointed engineer-in-charge of the new television transmitting station at Wenvoe, near Cardiff. Mr. Broadbent joined the staff of the B.B.C. in 1931 and served at the Moorside Edge transmitting station until 1935, when he transferred to Droitwich. In 1951, he was for a short time at the television transmitting station at Sutton Coldfield, and later became assistant engineer-in-charge at the Holme Moss television transmitter, which post he has held until his present appointment.

In our last issue we reported that **Mr. E. A. Anderson** had had a knighthood conferred upon him in the Birthday Honours, and we now reproduce his portrait. Mr. Anderson is well known in electrical circles in the North and is a principal of A. Anderson & Son (Electrical Engineers), Ltd., Middlesbrough, who are members of the South Durham and Yorkshire branch of the Electrical Contractors' Association.

Mr. E. A. Anderson

Mr. J. G. Smith, M.Inst.F., retires from the position of generation engineer (operation), Group IV, London Division, British Electricity Authority, at the end of the present month, after forty-four years' service on the generation side of the industry. On 23rd May, at a complimentary dinner presided over by the Divisional chief generation engineer (operation), he was presented with a watch by the divisional controller. Mr. Smith was accompanied by Mrs. Smith. He is a native of Essex, and after four years at King's College, he started his career in 1908 at the Wandsworth generating station of the County of London Electric Supply Co., Ltd., and five years later he was appointed engineer-in-charge at the City Road station, now dismantled. In 1924 Mr. Smith was made one of the original engineers-in-charge at Barking, then nearing completion, later becoming assistant boiler house superintendent and then boiler house superintendent. He was appointed station superintendent from 1945 until vesting date, when he was appointed to the position from which he has just retired.

Mr. J. O. Knowles, M.A., M.I.E.E., who is chairman and joint managing director of Brookhirst Switchgear, Ltd., has been elected president of the Liverpool Section of the Institution of Production Engineers for 1952-53.

Mr. R. E. Ayers has been appointed resident engineer in the Irish Republic for the Rheostatic Co., Ltd. Mr. Ayers has been at the company's Slough works for many years. For the time being he will work from his private address at 138, Dean Swift Road, Ballymun, Dublin.

Miss Muriel B. Marris has been awarded the eighth travelling exhibition by the Caroline Haslett Trust, which enables holders to study some aspect of domestic electrification in another country. She is the senior demonstrator at the South Wales Electricity Board, Western Sub-Area, Carmarthen, and in 1951 was the winner of the Elizabeth Sloan Chesser Cup awarded to the demonstrator who gains the highest marks in the tests for the E.A.W. Diploma in Electrical Housecraft.

Miss Marris will make a study of conditions in Norway.

Dr. C. J. Milner, head of the physics section of the research laboratory, British Thomson-Houston Co., Ltd., Rugby, has been appointed to the Chair of Applied Physics at the New South Wales University of Technology, Sydney, Australia, where he will be taking up duty in October next. The son of Mr. S. R. Milner, F.R.S., Emeritus Professor of Physics in the University of Sheffield, Dr. Milner was born in 1912, and was educated at King Edward's School, Sheffield; Worksop College, Notts; and Cambridge University. Matriculating as a scholar of St. John's College in 1930, and taking the B.A. degree in 1933, he worked as a research student in the Royal Society Mond Laboratory under Prof. P. Kapitza, F.R.S., the late Lord

Dr. C. J. Milner

Rutherford and Dr. J. D. (now Sir John) Cockcroft. He received the Ph.D. degree for a thesis entitled "The magnetic-resistance effect in cadmium at low temperatures." He is a Fellow of the Institute of Physics. Dr. Milner joined the research staff of the B.T.H. Co. in 1936, and worked before the war mainly on discharge lamps and photo-cells. His wartime activities were on the development of ultra-short-wave klystron and magnetron valves. The physics section, of which Dr. Milner has been the head since 1945, has been responsible for continued work on magnetron valves, and on infra-red devices and physical analysis.

Mr. E. Simpson, D.F.C., has opened a Canadian office for Wild-Barfield Electric Furnaces, Ltd., at 72, Grenville Street, Toronto. Mr. J. E. Simpson has returned to Canada after an absence of fifteen years. He was born in Edmonton and came to England in 1937. On the outbreak of war, he joined the R.A.F. with whom he served as a pilot for two years, transferring subsequently to the Royal Canadian Air Force for a further four years' service. He joined the Wild-Barfield organization in 1946.

Mr. R. Jessel, Ph.D., B.Sc., A.R.C.S., F.Inst.P., A.M.I.E.E., has been appointed chief of the Engineering Division of Electronic Tubes, Ltd. Dr. Jessel has had very considerable and varied experience in the fields of science and engineering, and has held several key positions. From 1926 to 1933 he attended the Imperial College of Science and Technology, during the latter part of which period he was engaged in teaching physics to honours degree standard, and research work at the College led to his gaining a Ph.D. degree. He joined the Gramophone Co., Ltd., in 1933 and was for some years connected with all scientific work in relation to the design and manufacture of H.M.V. household appliances. In 1940 he transferred to the Cathode Ray Tube Department where he designed many major items of plant and equipment. Dr. Jessel joined Parnall (Yate), Ltd., in 1945 as chief of research of Ascot Gas Water Heaters, Ltd., and Nash & Thompson, Ltd., where he remained until taking up his present position.

Two sales appointments have recently been announced by the company. **Mr. Kenneth Moore** becomes export sales manager and **Mr. L. R. Thompson** assistant sales manager. Mr. Moore was connected with the electric lamp industry from 1932 until 1941. He was sales director of a large engineering concern for a time and before taking up his present appointment was export sales manager of a wholesale firm.

Dr. R. Jessel

Mr. K. Moore

Mr. L. R. Thompson

Mr. Thompson entered the retail side of the radio trade in 1928. For the greater part of the war he was manager of the Cathode Ray Tube Department of Electronic Tubes, Ltd., and in 1945 transferred to valve production, taking over control of a large section of the Department. In 1948 he joined the Sales Department where he held the positions of maintenance sales manager and sales planning and distribution manager.

The Metropolitan-Vickers Electrical Co., Ltd., announces that **Mr. E. V. Winstanley**, B.Sc.Tech., M.I.Mech.E., chief engineer, Condenser and Gear Engineering Department, has been transferred to the staff of the chief mechanical engineer for special duties and **Mr. W. H. Darlington**, M.B.E., M.Sc., Ph.D., A.M.I.Mech.E., assistant chief engineer, has been appointed to succeed Mr. Winstanley as chief engineer of the Department.

Mr. Winstanley took mechanical engineering at the Manchester College of Technology and joined the British Westinghouse Co. in 1907 as a college apprentice at Trafford Park. After a period in the gas engine sales organization he joined the design staff of the Mechanical Engineering Department where he was engaged in the early development of turbine speed reducing gears for land and marine installations. Since 1924 he has been particularly associated with steam condensing plant and heat exchange auxiliaries for power stations, and for the last eight years he has occupied the position of chief engineer of the Condenser and Gear Engineering Department. Mr. Winstanley is a past Council Member of the North Western Branch of the Institution of Mechanical Engineers and was joint author with Mr. H. L. (now Sir Henry) Guy of an I.Mech.E. paper on "Some Factors in the Design of Surface Condensing Plant." He is a Past President of the Manchester College of Technology Old Students' Association.

Dr. Darlington received his technical education at the City and Guilds Engineering College. He joined M-V as a college

apprentice in 1935, and during his initial employment on general turbine work became interested in gas turbines. From 1939 he was engaged in gas turbine development for aircraft propulsion. In 1948 he visited Canada and the United States on the company's behalf and in 1949 he joined the Condenser Engineering Department, becoming assistant chief engineer in January, 1950. Dr. Darlington, who is an Associate Fellow of the Royal Aeronautical Society, gained his M.Sc. in 1935 for a thesis on "Heat Transmission and Fluid Friction for Air-Flow Past Roughened Surfaces," and for his doctorate he submitted a thesis on "Air Jets for use in Gas Turbine Combustion Chambers." He was awarded the M.B.E. in the 1948 Birthday Honours.

Mr. L. A. Moir has joined Thorn Electrical Industries, Ltd., as London area manager of the "Atlas" lighting division. Mr. Moir was for twenty-five years with the Revo Electric Co., Ltd., resigning as London branch manager in 1946 to become home sales manager with Parnall (Yate), Ltd.

Mr. L. A. Moir

Mr. W. H. A. Belliss has joined Merz & McLellan and will be going out to Greece for them shortly. Mr. Belliss was borough electrical engineer at Brighouse before vesting day and has since been manager of the Todmorden District of the Yorkshire Electricity Board.

Her Majesty The Queen has granted her Patronage to the British Institution of Radio Engineers

Mr. N. L. White, B.Sc.(Eng.), has been appointed assistant lecturer, grade B, in electrical engineering at the Technical College, Brighton.

Mr. N. McPherson has been appointed a director of the Aluminium Corporation, Ltd. He will remain general manager.

Mr. W. Davies, M.B.E., radio officer No. 1 in the records of the Marconi International Marine Communication Co., Ltd., was guest of honour at a private luncheon held at the Connaught Rooms, London, on 10th June to mark the completion of his fifty years of service with the company. Sir George H. Nelson, chairman of the English Electric group of companies, presided at the luncheon and presented Mr. Davies with a cheque. Among others present were Major-General L. B. Nicholls, C.B., C.B.E., chairman of Cable & Wireless, Ltd.; Mr. T. A. Davies, inspector of Wireless Telegraphy, G.P.O.; and Mr. R. D. Bangay, who himself recently celebrated his fiftieth anniversary with Marconi's Wireless Telegraph Co., Ltd. Directors and senior officials of the Marconi International Marine Communication Co., Ltd., and Marconi's Wireless Telegraph Co., Ltd., included Brigadier-General Wade H. Hayes, C.B.E., Mr. H. C. Van de Velde, Mr. R. Ferguson and Mr. F. N. Sutherland.

Mr. A. R. Lacey informs us that he is taking up duties at the Birmingham office of Crompton Parkinson, Ltd., as welding specialist for the Birmingham and Bristol areas.

The fifteenth annual meeting of the Board of directors of the International Federation of Business and Professional Women is to be held in New York from 24th to 26th June. For the first time in the United States the board will meet under the presidency of a British woman, **Dame Caroline Haslett.** Among other delegates is **Mrs. Rosalind Messenger,** M.B.E., J.P., who is adviser on women's work to the Eastern Electricity Board. After the board meeting, Dame Caroline Haslett will go on to Boston for the biennial conference of the American Federation of Business and Professional Women's Clubs, and then to Vancouver for the biennial convention of the Canadian Federation.

Mr. R. P. Mason, commercial manager to Venner Accumulators, Ltd., and **Mr. C. L. Chapman,** chief development engineer, leave London on 21st June for Norway and Sweden to discuss with government departments the latest lightweight Venner silver-zinc accumulators, with the object of increasing exports to Scandinavian countries.

Mr. A. Potts, manager of the South American Division of Hoover, Ltd., who last week returned from a visit to South America, in the course of which he travelled 25,000 miles by air, is being presented with a gold watch on completing twenty-five years' service with the company.

We learn from the *New Zealand Electrical Journal* that **Mr. H. E. Taylor,** of Wellington, has retired from the position of managing director in New Zealand for the British General Electric Co., Ltd., and he has been succeeded by **Mr. S. C. Brown,** B.Sc., M.I.E.E., assistant managing director.

Mr. Taylor joined the G.E.C. in London forty-five years ago and was transferred to Australia in 1912 where, in 1918, he became manager of the company's branches in Victoria, South Australia and Tasmania. He went to New Zealand in 1923 as manager of the New Zealand branch of the Australian section of the company, and when the British General Electric Co. was formed in 1936 he became managing director. He helped to form the New Zealand Electrical Federation of which he was the first president.

Mr. Brown joined the A.E.G. in Berlin after graduating from Manchester University and later joined the G.E.C., spending some years at

Witton before becoming engineer to the New Zealand organization. He was appointed assistant managing director in 1950.

Mr. Ayres, general manager of Petters, Ltd., has been appointed managing director. Before being appointed general manager last July he was for five years works director (Loughborough) of the Brush Electrical Engineering Co., Ltd. **Mr. A. E. Carrodus,** whose resignation from the board of the National Gas & Oil Engine Co., Ltd., was announced last month, has been appointed to the board of Petters, Ltd., as sales director.

Despite an overcast sky and the threat of rain (which fortunately did not materialize) the attendance at the annual sports and gala of the London establishments of the **General Electric Co., Ltd.,** which was held at the company's sports ground, Wembley, on Saturday last, was as large as in previous years, and those who attended were well repaid by a programme of some forty-eight events in which there were many exciting finishes. The rivalry between the various London establishments of the company was as keen as ever. Head office retained the Leslie Gamage trophy for the leading establishment, and it has now won this trophy in four successive years. In addition to the track events, there were the usual side shows which were well patronized, and for the children there were a Punch and Judy show, a model railway and other amusements. Mr. L. C. Gamage, vice-chairman and joint managing director, with the Hon. Mrs. Leslie Gamage, was present with other directors, and Mrs. Gamage distributed the prizes. A successful day was concluded with a dance in Hirst Hall.

The **Franki Compressed Pile Co., Ltd.,** celebrated its 21st birthday by a dinner and dance in London last week, a happy event of electrical interest because the company has been responsible for the piling of many important power stations in this country, including North Tees, Meaford and Staythorpe. Mr. W. McCarthy, chairman and managing director, proposed "The Founders," and Mr. E. Frankignone, inventor of the "Frankipile," Commander D. McG. Newton, consultant director, and Mr. A. Jourdain, all responded. Speaking in French, Mr. Frankignone expressed the gratitude of all on the Continent for the inspiration received from this country during the war. Mr. C. H. Bunclark, director, proposed "Our Guests," referring to the help received from the technical press; the response was by Sir George Cullum Welch, the company's legal adviser.

Submarine Cables, Ltd., owned jointly by Siemens Bros. & Co., Ltd., and the Telegraph Construction & Maintenance Co., Ltd., gave a luncheon at Claridges on 11th June. Mr. F. A. Lawson, chairman of Submarine Cables, Ltd., and managing director of Siemens Bros. & Co., Ltd., presided and the principal guest was Earl de la Warr, Postmaster General. Mr. Lawson said that it was an exceptional occasion since Submarine Cables, Ltd., the successors of the main field of submarine cable manufacturing business so long carried on by Siemens Bros. and Telcon, were meeting the representatives of long established cable operating companies and their successors. Telcon celebrated its centenary in 1950 and Siemens Brothers would celebrate theirs in 1958. Earl de la Warr, in reply, referred to the fact that Submarine Cables, Ltd., and its parents, Siemens and Telcon, had produced about 90 per cent of the world's total submarine communication cable installations, and said it was well that the world should know of British achievements such as this. Although he could not say when it would come about, he proposed a toast to the Atlantic telephone cable, a project uppermost in the minds of cable engineers and others on both sides of the Atlantic. Among those present were Mr. J. N. Dean, managing director of Telcon and Submarine Cables, Ltd., and General Sir Hubert Gough and Lord Colgrain, chairmen of Siemens and Telcon respectively.

The competition for the transatlantic trophy presented by the chairman of **Ferranti, Ltd.,** Sir Vincent de Ferranti, for competition among members of the staff of the Hollinwood, Moston, Edinburgh and Canadian factories, was played on 10th June at Blackley for the Hollinwood and Moston competitors, at Newbattle for the Edinburgh competitors, and in Canada for the Canadian members. The winner this year was Mr. G. Cowan, a member of the radio and television sales staff in the East of Scotland area. Mr. Cowan played with the Edinburgh competitors over the Newbattle course and returned a score of 77-12=65, representing six under bogey. Mr. C. Brunning, of the Canadian staff, returned 67 net and Mr. H. L. Chapman of Hollinwood returned 66 net, both these representing four under bogey.

In our issue of 6th June we reported the inauguration of a scheme of long-service awards by **Asea Electric, Ltd.** The first presentations were made at a special dance held at Walthamstow Assembly Hall on 13th June. Before presenting the awards to forty members of the staff, six with over forty years' service, Mr. H. V. Pointer, managing director, read a telegram of congratulations from the chairman, and said that futher presentations would be made at the annual Christmas dance. Mr. W. A. Hunt responded on behalf of the long-service award recipients and dancing continued for the rest of the evening.

At the annual sports meeting of the **Eastern Electricity Board's Northmet Sub-Area** at "Woodcroft," Winchmore Hill, last Saturday, record times were returned for

the mile championship and for the 1 lap cycle race. An Enfield A.C. team competed as well as entrants from Essex and Cambridgeshire and from eleven local branches. Several hundreds of people enjoyed the excellent competitions and the other entertainments which included square dancing, and for the less energetic there was a balloon race. Children had a sports meeting of their own as well as a Punch and Judy show and the North London "Emmett" Railway. Essex Sub-Area won the mile relay race and secured best placings in the invitation half-mile. Individual triumphs were scored by R. Gooch-Harris, who retained the mile championship and won the half-mile handicap, and by J. Cranston who won three cycle events. Miss J. Plater won both the ladies' 80 yards championship and the handicap. Standard Telephones kindly lent sports gear and their officials helped on the track.

OBITUARY

Mr. A. H. Banks.—The death has occurred at his home at Beckenham, Kent, of Mr. Alfred Herbert Banks, O.B.E., who in 1950 retired from the position of chief labour relations officer of the British Electricity Authority. Mr. Banks, who was sixty-six, was born in Manchester and began his career in the Town Clerk's Department of that city. From 1917 he was engaged wholly on industrial relations on behalf of the Corporation and also of the Association of Lancashire and Cheshire Local Authorities. He was appointed employers' secretary to the North Western District Council and Board for the Electricity Supply Industry in 1918 and in 1923 left the Corporation to become clerk to the South East Lancashire Electricity Advisory Board established under the Electricity Supply Act, 1919, but remained the secretary of the North Western District Council. When the South East Lancashire Board was disestablished in 1930, Mr. Banks was appointed employers' secretary to the N.J.I.C. and N.J.B. for the Electricity Supply Industry. During the 1939-45 war he acted with Mr. C. J. Hornsby (Electricity Commission) as joint secretary to the Man Power Committee appointed by the Commission, the N.J.I.C. and the N.J.B. to deal with problems relating to the balance between the requirements of the industry and the Services. In 1938 he was appointed employers' secretary to the National Joint Committee for Local Authorities and Chief Electrical Engineers which negotiated the terms and conditions of the engineers' salaries. On 1st October, 1947, Mr. Banks became chief labour relations officer to the B.E.A., but retained his appointments in the employers' organizations until vesting date.

The late Mr. A. H. Banks

Mr. F. T. Milne.—The death occurred suddenly at his home on 6th June at the early age of forty-six of Mr. Frederick Trevor Milne. He was educated at Dover College and at the City and Guilds College, South Kensington. Beginning his service with the General Electric Co., Ltd., in India he subsequently joined the Illuminating Engineering Department at the head office of the company in London, and up to the time of his death held a position as one of the company's principal illuminating engineers. He was a Fellow of the Illuminating Engineering Society.

Dr. Ing. F. Grunewald, A.M.I.E.E., died suddenly on 13th June at his home at Manchester. He was born in Westphalia in 1889 and studied at Technische Hochschule, Berlin, ultimately gaining one of the first degrees conferred by this University in Germany. Subsequently he worked on insulation problems including early impulse voltage investigations, and on circuit breaker development and testing. He was also interested in patent procedure. Dr. Grunewald joined Ferguson, Pailin, Ltd., in 1937 and was engaged on h.v. research and the development of airblast breakers of which he had specialized knowledge. He was the author of "Das Verhalten der Freileitangs-isolatoren unter der Einvirking Hochfrequenter Spannungen." He also wrote an article in 1944 on Continental and American airblast breaker development.

Mr. P. W. V. Fright.—We are sorry to learn of the death, at the age of sixty-eight, of Mr. P. W. V. Fright, whose retirement from the position of London sales manager to the Jackson Electric Stove Co., Ltd., we reported only three weeks ago. Mr. Fright, who died on 12th June, joined the sales staff of the company in 1929, and became London sales manager in 1935.

Mr. P. H. Jackson, M.I.E.E., of Olton, Birmingham, who died on 8th June at the age of sixty-three, was a former consultant engineer to J. Garrington & Sons, Ltd., of Bromsgrove.

WILLS

Mr. E. J. Edgar, controller of the South West Scotland Division of the British Electricity Authority, who died on 10th December, left estate in Great Britain valued at £7,983 gross (£5,926 net).

Sir Arthur Rundell Guinness, K.C.M.G., chairman of the London Electrical & General Trust, Ltd., who died in Bombay on 12th March, 1951, left estate in England valued at £152,153 gross (net value nil).

CORRESPONDENCE

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

The Future Demand for Coal

IT is fashionable nowadays to make alarming references to the impossibility of meeting the future demand for coal and to criticize all classes of coal users for their part in bringing about this state of affairs. The old type of domestic grate is blamed, very rightly no doubt, for its inefficiency and voracious appetite, industrial users are told they must be less prodigal in their use of fuel, the gas industry gets a kick because it apparently uses too much coal of an exportable type and in doing so produces coke which ordinary people often find difficult to burn, while those who wish to make full use of the benefits which the inventors of electrical generation have given the world are in danger of being classed as "saboteurs."

Everyone will agree that increased efficiency in the use of *every* commodity is important, especially so in the case of fuel. Much, however, has been and is being done. New grates are being installed in our homes, efforts are being made to increase the efficiency of the production of gas and of the appliances which use it and the power stations are bettering each year the very great achievements already made in producing more electricity per ton of the low grade fuels delivered to them.

What do we find, however, when we examine the Federation of British Industries estimated future demand for coal? Whereas the net home coal consumption for 1951 was about 194 million tons, the F.B.I. estimates that by 1961–65 it is likely to rise to some 256 million tons. During the last fifty years the consumption per head of population only exceeded 4 tons a year during the artificial conditions of the 1914–18 war. Assuming therefore that the population goes on increasing at the present rate (statisticians say it is more likely to slow up) and that despite the increased efficiency brought about by the new grates and more efficient gas and electrical production and use, the coal consumption per head does not fall substantially below 4 tons a year, it is probable that coal consumption in 1961–65 will be 52 million $\times 4$ tons, or about 208 million tons. This is nearly 50 million tons less than the F.B.I. estimates.

Is there any need for the present panic? The F.B.I. estimates seem to have been arrived at by simply extending the total net home coal consumption line on the assumption that it will follow the trend shown for the last five years. If, however, the same procedure had been adopted for the years 1900–17 and the total home consumption line extended to the year 1951, it would have shown the expected home consumption of coal to be 250 million tons by then, or over 5 tons per head of the population.

Why hasn't this happened? One of the main reasons is that electricity supply started a period of most rapid development about 1916 and the efficiency of use increased so much that many millions of tons of coal were saved over the years and use was made of low grade coals for which previously there had been little home demand. Moreover, the efficient use of these low grades of coal enabled the increase in productivity to be achieved without a correspondingly large increase in the consumption of industrial coal.

What about export? Gross production is expected to reach at least 240 million tons by 1965. If the consumption per head of the population does not fall below 4 tons per annum by then there will be an apparent balance of 240 million minus 208 million or 32 million tons in that year. After allowing, say, 7 million tons for colliery use, there will be some 25 million tons available for export—a much better position than exists to-day and more cheering than the present gloomy forecasts.

Brighton. R. E. GAMLEN.

"Athermic" Generation

I HAVE been in retirement for some years now and have lost interest in most electrical problems and development, except in one which dates back to the days when primary cells of all queer kinds were the joy of young experimenters and electricians.

A paragraph in the morning press prompts me to wonder if there are many folk whose minds have played with this idea through the years and if anything has been achieved.

I have always called the arrangement the "athermic generator" and have been surprised that folk have seldom thought of fuel except as something to be burnt in the good old way under a boiler, or in a cylinder, when wishing to obtain energy.

Perhaps if Faraday had not succeeded in obtaining current from motion so early in the history of electrical engineering, the primary cell would not have been so neglected and years of development would have produced the athermic generator about the time of my middle age. If a freak of nature had produced a mine of *metallic* magnesium in a land where one of our heat-cycle engineers lived, and if he had wished to light his house electrically, he would have drawn the metal out into thin rods, ignited them and fed them blazing under a boiler to run a steam engine and dynamo. He would never have thought of sticking his rods into cells, with some sort of air feed to the other pole, thus obtaining his current without going through the fuel-heat-motion-electricity process. No heat losses, wear and tear, bearings, lubricants, boiler tubes and valves and odds and ends!

Of course if he had tried the primary cell idea, he and his friends might have spent the rest of their lives getting an arrangement rigged up which would work decently, especially if they had turned to more normal fuels when their magnesium failed them, but at least they would have got the heat engine bat out of the belfry.

Suppose, further, that our heat engine electrician lived near an Arctic sea; the sight of powerful cold blooded marine creatures dashing around and obtaining their energy by oxidizing their food-fuel *in the cold*, with never a flame or a sparking plug in their bellies, would still not have moved him to say: "And the only single time mankind has done it is in the primary cell; I have one in my pocket now, cold as charity, but still it will work my torch!"

All nature is full of creatures producing energy in this cold-process way, but mankind found out how to boil a kettle and that started him out on the road of the hot bearing; all mankind, that is, save only the neglected Volta! Even the violent shock of the electric eel has not knocked the "heat idea" out of engineering despite the fact that the eel possesses a lovely set of primary cells.

Years ago I often said that the athermic generator would eventually oust the heat engine, at least for heavy fixed plants, unless atomic energy got there first. Ten years ago I would have said the atomic generator would be the winner, but now that looks doubtful, unless of course one accepts an ordinary heat engine using uranium (or like elements) as *fuel* with steam or mercury vapour or some such arrangement, as "atomic energy." I had expected the "back room boys" to find some way to realize that atomic energy was in the first place an electrical phenomenon, to try to persuade it to *stay* so, and to collect their current without letting it drop into the heat engineer's lap first.

If the athermic generator "comes off," either it will be something like Graves' gas cell with, I think, the gas "fuel" activated in some way, probably by a silent discharge type of "hook-up" and using normal gas fuels, or by preparing a special chemical fuel whose potential energy has been obtained at the expense of a normal fuel's oxidation.

G.S.

Displays at Bournemouth

As is usual during the period of the British Electrical Power Convention a number of electrical concerns have arranged displays locally. Among those to be seen at Bournemouth by Convention delegates was one arranged by the Jackson Electric Stove Co., Ltd., at the Westover Garage. This comprised a background of cookers and in the foreground a small shovel-full of slack. It was declared that electrical equivalent of this slack (2½ kWh) would cook a meal for eight people.

At the Bournemouth Electricity Service Centre the Simplex Electric Co., Ltd., secured the principal show window for an exhibition of equipment including a "Comet" horizontal cooker, a restaurant range, a small domestic cooker, a unit type range, a wash boiler and irons. There was also a selection of cooker control equipment; Lundberg accessories, including a new 13 A switch socket and the "Marvel" switch; and floodlights.

Gillott Electro-Steam Cookers, Ltd., had a room at the Royal Exeter Hotel in which were shown examples of the "Duo Coil" immersion heater in complete and skeleton forms for various applications.

PARLIAMENTARY NEWS

From Our Special Reporter

IN the House of Commons Mr. Kenneth Thorneycroft asked the Assistant Postmaster General to what extent the Post Office was undertaking development work in the field of electronic switching equipment for telephone exchanges.

Mr. Gammans said that there had been considerable progress in the design of this entirely new type of telephone switching equipment, as a result of research work at the Post Office Station at Dollis Hill. The aim was to provide telephone exchanges operated entirely by electronic means instead of by the present type of electromechanical switch. The electronic apparatus had no moving parts, was almost instantaneous in operation, and might eventually prove more economic in first cost as well as maintenance. The immediate outcome of the work at Dollis Hill was an experimental installation of six electronic directors which had recently been installed in the Richmond Telephone Exchange. This new installation probably represented the first instance in the world of the use of a fully electronic item of switching equipment in a public telephone exchange.

He was sure the House would note with satisfaction that this very promising development arose out of the independent research work at the Post Office Station at Dollis Hill, and that this country was in the front line of development in this new field. There were many research problems and practical difficulties still to be overcome, and it would be some years before the basic electronic design could be developed as a complete switching system available for manufacture and for installation in new exchanges.

Telephone Delays

When the Post Office and Telegraph (Money) Bill was considered in Committee, Mr. Gammans, the Assistant Postmaster General, said that more than half a million people wanted telephones, but the exchanges were so full that during the present year only about a fifth of the waiting list would be dealt with. The biggest headache of the Post Office now was the retarding of the telephone service. There was a very real danger that we should soon be running into a very serious situation.

Rural Electrification

During a debate on agriculture in the House of Commons, Mr. Cledwyn Hughes, a Welsh Labour member, said that if the farmers of Anglesey and of other Welsh counties were to compete on equal terms with their more fortunate brethren in the south and east of England, then rural electrification in Wales must be given top priority. Quite reasonable progress had been made since electricity was nationalized, but it seemed that far more progress had been made in connecting farms in England than in Wales. In Anglesey there were only 115 farms with electricity (3·5 per cent of the total) and of these farms only 42 (1;3 per cent) got electricity from a public source.

Mr. Nugent, the Parliamentary Secretary to the Ministry of Agriculture, said that the Minister was well aware of the need and in spite of the present stringency he had been able to restore £1,000,000 of the cut made last autumn.

Scientific Research and Industry

Lord Samuel opened a debate in the House of Lords last week on the use made by industry and agriculture of scientific research. He said that one could give a single illustration of the immense benefits that might be derived from scientific application in concerns which had been going on for generations. The British Electricity Authority informed him that in the short period of three years preceding and including 1951 improvement in the methods of utilizing coal had resulted in a saving of 2,000,000 tons a year, in spite of a lowering of the quality of the coal.

Lord Woolton, Lord President of the Council, spoke of the value of the work of the Department of Industrial and Scientific Research, especially in the realm of fuel economy. The Fuel Research Station, he said, had made important advances in the design of heating appliances and insulation for domestic and other buildings. They had developed a simple and cheap device, which, when fitted to the doors of hand-fired Lancashire boilers, prevented the emission of smoke. This device was being produced by a large number of firms, and when it was in general use the saving of coal would be considerable. Largely as a result of intimate co-operation between the Iron and Steel Research Association and industry, Great Britain led the world in the design and in the instrumentation of open hearth steel furnaces. As a result of the Association's work, the weekly output of many of the melting shops had been increased by as much as 20 per cent, and it was calculated that the saving in fuel consumption amounted to over £1,000,000 a year. He also spoke of the advance in radar research.

Lord Sempill said that electric power generation was continually increasing, and that generated by coal as opposed to water should soon be produced more economically. But in the State-owned industries of electric power

generation the rapid adoption of new devices did not always take place at the rate which technical necessity demanded. The advantage to be gained by the installation of some new piece of equipment might be so convincing that several new area stations would be fully equipped, but there appeared to be no way through the bureaucratic maze at headquarters which would result in such a device, having proved itself at one or more of the big generating stations, being installed all over the country.

Atomic Power Prospects

Later in the debate, Lord Cherwell, the Paymaster-General and Scientific Adviser to the Government, said that the question of using nuclear energy had been before them for the last six or seven years, and the prospects of using it for peaceful purposes were really improving. No one claimed that it would be cheaper than energy from coal, or that in the foreseeable future it would replace ordinary fuel, but the more expensive coal got the more attractive nuclear energy became. We used 35 million tons of coal in 1951 to generate electricity. By 1960 another 13 million tons would be required. At that date it might be that people could consider nuclear reactors when they were debating how to build new power stations. But nuclear reactors would merely replace the boilers. The trouble with nuclear reactors was their high capital cost. In the ordinary pile which we had already got, less than one per cent of the uranium could be used, because it was only the lighter isotope 235 that was consumed. One ton of uranium, if the whole of it could be used, was the equivalent of between two and three million tons of coal, but as only one per cent could be used it would take 100 tons of uranium to get even a fraction of our coal consumption for power. Uranium was by no means easy to come by, and the whole of the world was being searched for it.

In a few years they hoped to test one of these piles made deliberately in order to produce energy driving a steam engine or something like it. There could be no doubt that it would work, but it would not be very economical. There was hope of making what was called a breeder reactor in which the fast neutrons were allowed to react on enriched uranium or plutonium, or whatever was started with. A certain number produced a great amount of heat, and the effect of a controlled bomb was reached. A lot of the neutrons escaped to the outside and if they could be surrounded with a breeder reactor with either thorium or U.238, the heavier isotope, then the escaping neutrons either produced uranium or plutonium, and in principle the plutonium so produced from the light uranium put into the middle could be used to breed fresh material, obtaining power, and so breeding fresh and fissile material. By this method they might be able to use the whole of the uranium, or something like 60 per cent of it.

The country was fortunate in having Sir Christopher Hinton and Sir John Cockcroft co-operating in trying to develop this fast reactor. It involved a long-term investigation and would require in the end considerable capital investment, but it was worth while and the prospects of success were considerable within a reasonable number of years.

One day, if we ever learned how to make hydrogen coalesce into helium, then heat would become a drug on the market because one pint of water, if it could be made to combine as hydrogen, was equivalent to 10,000 tons of coal.

Meters Bill

The Electricity Supply (Meters) Bill, which has passed through the Commons, has been read a second time in the House of Lords.

Pit-head Power Station

On Monday Mr. Snow asked the Minister of Fuel and Power whether the new power station adjacent to the Lea Hall Pit, Rugeley, which was now being sunk, would be in operation in time to receive direct supplies of fuel from the pit.

Mr. Geoffrey Lloyd, in a written reply, stated that the colliery and power station were being developed together. The British Electricity Authority informed him that it expected to commission the first generator in this station in 1958 by which time the colliery should be starting to produce coal. It was hoped to complete the station with a capacity of 540,000 kW by 1963 when the colliery should also have reached full production.

Croydon Grit Emission

In reply to a question by Mr. F. Harris regarding complaints by residents of grit emission from the Croydon "B" station, Mr. Geoffrey Lloyd, Minister of Fuel and Power, said that no complaints had been received by his Department, but the British Electricity Authority had informed him that it had received a number of complaints since last December. The B.E.A. reported that the station was equipped with the most up-to-date plant for preventing the emission of grit from the chimneys, but it was possible that some of this was not working properly. Investigations into the cause of the trouble were continuing.

Volta River Project

In reply to Mr. George Strauss, Mr. Mackeson, Secretary for Overseas Trade, said that the United Kingdom Government was greatly interested in the potentialities of the Gold Coast as an additional sterling area source of aluminium. Participation in the Volta River project would involve heavy capital commitments and certain points would require further examination before the Governments and companies would be in a position to undertake any commitments.

Coal Price Structure

N.C.B. System Explained

IN a booklet of eleven pages the Federation of British Industries explains the price structure for coal introduced by the National Coal Board on 31st December last. From the calorific value of coal as received is deducted an ash "penalty" which rises steeply with the percentage of ash; e.g. for 10 per cent it is 260, for 20 per cent 1,030 and for 30 per cent 2,440 B.Th.U./lb. Thus a coal of 11,000 B.Th.U./lb as received and containing 12 per cent of ash would have a corrected c.v. of 11,000 − 360 = 10,640 B.Th.U. to which a points value of 106·4 would be assigned. The datum is a washed coal of between ½ and 1in with a points value of 112·5 to which an index price of 43s per ton has been given, one point therefore costing 4·59d. To meet increases in mining costs subsequent to the drawing up of the scheme, overall prices have been increased by 10 per cent above those here stated.

For expenses incurred by the N.C.B. in washing or cleaning coals, up to 1s 9d per ton is added; untreated smalls benefit by rebates of 1s 6d to 3s 3d depending on size and quality. Certain characteristics, such as sulphur content and friability, are allowed for by minor adjustments, usually less than 1s per ton for bituminous coals. Coals have been classified to give a series of group prices differing (prior to the 10 per cent increase mentioned above) by 1s 6d as a maximum.

To the coal field price is added in most cases a sum of 3s to 8s (with extremes of nil in the N.E. and East Midlands Divisions and 13s in the S.E. Division) to allow for varying costs of production and existing market relationships. With coals for carbonization, coking properties and proportionate quantities of volatile and fixed carbon constituents have also to be taken into account. For anthracite a separate method of evaluation has been used, depending on rank sub-division based on hydrogen and ash contents and size. The rank of a coal, which largely determines its performance in operation, depends mainly upon the age of the coalfield. The N.C.B. classifies British coals into the nine main groups set out below with reference to their coking properties and volatile content.

COAL RANKS AND PROPERTIES

Description	Caking properties	Inherent moisture per cent	Dry ash-free coal			Special uses
			Volatile matter per cent	Carbon per cent	Cal. val. B.Th.U./lb	
Anthracite	Non-caking	1·5— 3·0	9·5 & less	92·0—94·5	15,250—15,600	Closed stoves
Low volatile steam coals	Non-caking to strongly caking	0·7— 1·2	9·6—20·0	89·0—93·0	15,300—15,950	Closed stoves; high duty steam raising; blending for coke making
Medium volatile coals	Very strong	0·6— 2·0	20·1—30·0	85·5—91·0	15,300—15,900	Foundry and high-grade blast furnace coke
High volatile	Very strong	0·6— 2·5	30·1 & over	85·0—91·0	15,200—15,900	Blast furnace coke and gas making
High volatile	Strong	1·1— 4·0	do.	84·0—87·0	15,000—15,600	
High volatile	Medium	1·6— 5·5	do.	83·0—86·5	14,800—15,400	
High volatile	Weak	2·1—10·0	do.	82·5—86·0	14,600—15,200	Domestic and general industrial use
High volatile	Very weak	3·6—11·5	do.	80·0—85·0	14,100—15,000	
High volatile	Non-caking	5·6—13·5	do.			

New Trams for Blackpool

Charles Roberts & Co., Ltd., Wakefield, have just despatched the first of twenty-five "luxury" trams ordered by the Blackpool Corporation. Each tram costs £10,000 and has fluorescent lighting the whole length of the 50ft coach, and pneumatically controlled doors.

Colonial Engineering

Third Conference in London

THE series of conferences on the above subject which has been organized by the Institution of Civil Engineers is intended primarily for engineers engaged in the Colonial Service and others concerned with similar work overseas. The third conference of this series has been held in London this week, during which the annual conversazione of the Institution has also taken place.

The seven papers presented on five days dealt with the need for road research, railway engineering and the collection and supply of water. The water resources of Southern Rhodesia and their development were described by Mr. E. H. Haviland, who outlined stages in the development of the Irrigation Branch of the Agricultural Department which was responsible for all water supply installation at Government stations, including the operation of water boring machines, and water storage for stock, irrigation and domestic uses. The use of water from the River Zambesi must be dealt with separately, he said, since it was the concern of a number of countries. Utilization of water from the reaches of that river bordering the Colony was likely to be controlled to a large extent by the power potential of the river but the development of power would not prevent some use of the water for irrigation purposes in the Zambesi valley. The use of Zambesi water elsewhere was likely to be confined to purposes other than irrigation because of the high cost of pumping.

The average annual discharge of the river at Victoria Falls was about 25·4 million acre-ft, increasing at Kariba Gorge to 33·7 million acre-ft. Should the Kariba power scheme, which was planned to develop 1,000 MW and would involve the construction of a dam to store about 84 million acre-ft, be proceeded with, then the use by Southern Rhodesia of Zambesi water above that gorge would almost certainly be precluded, except for a small abstraction, although a portion at least of the discharge of 30,000 cusecs from the dam would be available for use in the valley below.

The reasons for, and methods of proceeding with the development of hydro-electric power in Uganda were outlined by Messrs. C. R. Westlake and T. A. Lyell Paton, most of whose paper dealt with the economics of the Owen Falls scheme and some of the difficulties involved in the formulation of tariffs for the energy to be supplied. The paper indicated the capacity of the scheme, the use of Lake Victoria as a storage reservoir and its importance in connection with the regulation of the flow of the River Nile, some of the main features of the design of the works being described and an account given of the work already carried out.

Since the beginning of this year the labour force employed had reached a total of 1,400 Africans, 39 Asians and 136 Europeans, the last-mentioned being recruited principally from the United Kingdom, Holland, Denmark and Italy.

Delegates had opportunities of visiting several of the research laboratories of the Department of Scientific and Industrial Research as well as works of civil engineering interest. It is intended in due course to publish the proceedings of the conference.

AUSTRALIAN NEWS

OUR Australian Correspondent reports that the City Electric Light Co., Ltd., Brisbane, is raising £1,550,436 by a share issue at par to existing shareholders in the ratio of one to six. This will raise the company's paid-up capital to £10,853,054.

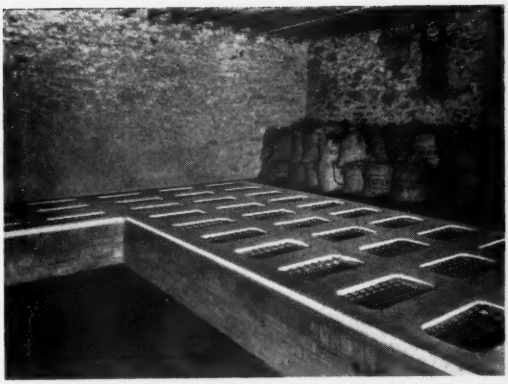
The £3,971,260 4½ per cent cash and conversion loan of the Electricity Trust of South Australia was oversubscribed by £1,530,000.

Tenders involving the expenditure of £4,297,606 to increase the supply of electricity in the Perth metropolitan area and in the south-west portion of Western Australia were recently accepted by the State Cabinet. The tenders included: C. A. Parsons & Co., England, two 30 MW turbo-generators with condensing plant for the new power station at Bunbury, £926,940, and a 30 MW turbo-generator for the East Perth generating station, £538,350; and International Combustion, Ltd., boiler unit, £623,016.

In-Sack Grain Drying

Economical Installations for the Smaller Farms

By H. D. PHELPS,
A.M.I.E.E., M.I.B.A.E.*



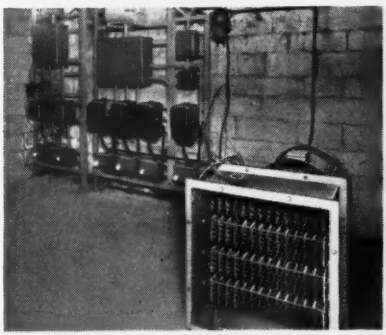
40-sack drying plant at Copitts Grange, Slaley

WITH the introduction of combined harvesters during the war and lack of large commercial grain dryers, farmers had to consider installing their own, and during the last part of the war several 2 and 3 ton/hr vertical type plants were installed on individual farms followed by a mass-produced grain dryer of 1 ton/hr for the farms with a smaller acreage of corn.

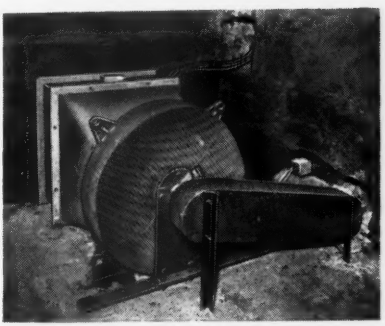
Since then the number of combines has considerably increased so that the question of drying has become of paramount importance. Following the development of the "Nu-way" in-sack oil-heated type of plant there are now available standard types of fans and heating equipment which make the use of electricity a safe and easy medium for this method of drying grain.

Such a plant has been installed by Capt. B. C. R. Nichol of Colpitts Grange, Slaley, for use in conjunction with his combine. Capt. Nichol's farm is situated 800ft above sea level and most of it is marginal land. However, he managed to put 110 acres under corn last season and dried 100 tons on his 40-sack dryer fitted with 36 kW G.E.C. heaters and a Woods of Colchester "Aerofoil" fan driven by a 1 h.p. motor. The supply here is single phase 240/480 V and only five switching operations are necessary to control the plant.

A similar 48 kW equipment, operating on a 3-phase system, was supplied to Mr. W. Laidler, jun., of Anick Grange, Hexham,



At Anick Grange, Hexham, the 49-sack No 1 plant employs a 48 kW heater and 2 h.p. fan



The drying unit for the No. 2 plant at Anick Grange has been made up from a standard propeller type fan, which is belt driven by a 2½ h.p. motor, and a 24 kW heater

* Farm and Rural Development Sub-Section, North Eastern Electricity Board.

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Third Conference in London

THE series of conferences on the above subject which has been organized by the Institution of Civil Engineers is intended primarily for engineers engaged in the Colonial Service and others concerned with similar work overseas. The third conference of this series has been held in London this week, during which the annual conversazione of the Institution has also taken place.

The seven papers presented on five days dealt with the need for road research, railway engineering and the collection and supply of water. The water resources of Southern Rhodesia and their development were described by Mr. E. H. Haviland, who outlined stages in the development of the Irrigation Branch of the Agricultural Department which was responsible for all water supply installation at Government stations, including the operation of water boring machines, and water storage for stock, irrigation and domestic uses. The use of water from the River Zambesi must be dealt with separately, he said, since it was the concern of a number of countries. Utilization of water from the reaches of that river bordering the Colony was likely to be controlled to a large extent by the power potential of the river but the development of power would not prevent some use of the water for irrigation purposes in the Zambesi valley. The use of Zambesi water elsewhere was likely to be confined to purposes other than irrigation because of the high cost of pumping.

The average annual discharge of the river at Victoria Falls was about 25·4 million acre-ft, increasing at Kariba Gorge to 33·7 million acre-ft. Should the Kariba power scheme, which was planned to develop 1,000 MW and would involve the construction of a dam to store about 84 million acre-ft, be proceeded with, then the use by Southern Rhodesia of Zambesi water above that gorge would almost certainly be precluded, except for a small abstraction, although a portion at least of the discharge of 30,000 cusecs from the dam would be available for use in the valley below.

The reasons for, and methods of proceeding with the development of hydro-electric power in Uganda were outlined by Messrs. C. R. Westlake and T. A. Lyell Paton, most of whose paper dealt with the economics of the Owen Falls scheme and some of the difficulties involved in the formulation of tariffs for the energy to be supplied. The paper indicated the capacity of the scheme, the use of Lake Victoria as a storage reservoir and its importance in connection with the regulation of the flow of the River Nile, some of the main features of the design of the works being described and an account given of the work already carried out.

Since the beginning of this year the labour force employed had reached a total of 1,400 Africans, 39 Asians and 136 Europeans, the last-mentioned being recruited principally from the United Kingdom, Holland, Denmark and Italy.

Delegates had opportunities of visiting several of the research laboratories of the Department of Scientific and Industrial Research as well as works of civil engineering interest. It is intended in due course to publish the proceedings of the conference.

AUSTRALIAN NEWS

OUR Australian Correspondent reports that the City Electric Light Co., Ltd., Brisbane, is raising £1,550,436 by a share issue at par to existing shareholders in the ratio of one to six. This will raise the company's paid-up capital to £10,853,054.

The £3,971,260 4¼ per cent cash and conversion loan of the Electricity Trust of South Australia was oversubscribed by £1,530,000.

Tenders involving the expenditure of £4,297,606 to increase the supply of electricity in the Perth metropolitan area and in the south-west portion of Western Australia were recently accepted by the State Cabinet. The tenders included: C. A. Parsons & Co., England, two 30 MW turbo-generators with condensing plant for the new power station at Bunbury, £926,940, and a 30 MW turbo-generator for the East Perth generating station, £538,350; and International Combustion, Ltd., boiler unit, £623,016.

In-Sack Grain Drying

Economical Installations for the Smaller Farms

By E. D. PHELPS,
A.M.I.E.E., M.I.B.A.E.*

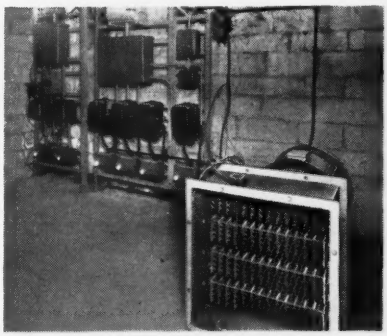
40-sack drying plant at Copitts Grange, Slaley

WITH the introduction of combined harvesters during the war and lack of large commercial grain dryers, farmers had to consider installing their own, and during the last part of the war several 2 and 3 ton/hr vertical type plants were installed on individual farms followed by a mass-produced grain dryer of 1 ton/hr for the farms with a smaller acreage of corn.

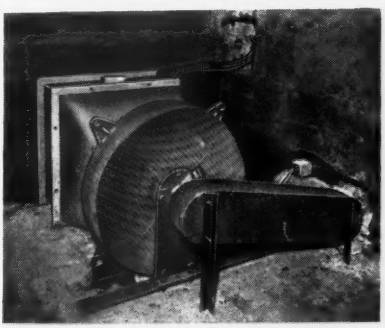
Since then the number of combines has considerably increased so that the question of drying has become of paramount importance. Following the development of the "Nu-way" in-sack oil-heated type of plant there are now available standard types of fans and heating equipment which make the use of electricity a safe and easy medium for this method of drying grain.

Such a plant has been installed by Capt. B. C. R. Nichol of Colpitts Grange, Slaley, for use in conjunction with his combine. Capt. Nichol's farm is situated 800ft above sea level and most of it is marginal land. However, he managed to put 110 acres under corn last season and dried 100 tons on his 40-sack dryer fitted with 36 kW G.E.C. heaters and a Woods of Colchester "Aerofoil" fan driven by a 1 h.p. motor. The supply here is single phase 240/480 V and only five switching operations are necessary to control the plant.

A similar 48 kW equipment, operating on a 3-phase system, was supplied to Mr. W. Laidler, jun., of Anick Grange, Hexham,



At Anick Grange, Hexham, the 49-sack No 1 plant employs a 48 kW heater and 2 h.p. fan

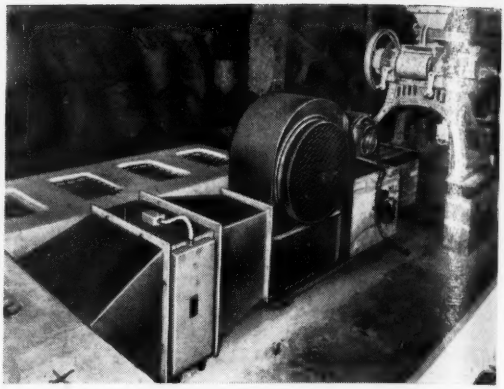


The drying unit for the No. 2 plant at Anick Grange has been made up from a standard propeller type fan, which is belt driven by a 2½ h.p. motor, and a 24 kW heater

* Farm and Rural Development Sub-Section, North Eastern Electricity Board.

for a 49-sack bank. This plant was so successful that he increased his drying area by a further bank of 30 grids. So late in the season (September) a self-contained electrical equipment was not available for this plant and one was made up from a standard "Davidson" propeller type fan, V belt driven from a 2½ h.p. motor, and a 24 kW G.E.C. heater.

Nearly 500 tons of grain were dried on these two plants since they were put into commission in September, to the complete satisfaction of seed merchants, maltsters and millers.



The motor driving the dryer fan at Aydon Castle, Corbridge, can also be employed for working a grinding and crushing mill

Snelgar & Sons, of Aydon Castle, Corbridge, also installed a 40-sack dryer equipped with No. 21 "Impulsitor Multivane" fan provided by the Air Impellor & Engineering Co., Ltd., and driven by means of a VV drive from a 7½ h.p. single-phase motor: this motor can also drive, by VV belts, the No. 3 C "Bamford" combined grinding and crushing mill. The heating element in this case is a 48 kW bank made by the G.E.C. With this equipment they dried about 130 tons of corn.

Preserving Rural England

Objections to Overhead Lines

ELECTRICITY supply again takes a prominent place in the 1951–52 annual report of the Council for the Preservation of Rural England. Several instances are mentioned in which the Council has endeavoured to persuade the electricity authorities to adopt underground transmission instead of overhead lines. In one case, the Abbeystead electricity scheme, Trough of Bowland, Lancs, the North Western Electricity Board was asked to place 640yd of line underground but it declined to incur the extra cost of £400. The Lancashire Branch of the Council thereupon offered to contribute £100 if the balance was found jointly by the Board and the County Council. At the date of the report the results of a local inquiry were awaited.

The Council also made an appearance at an inquiry into the Martindale electricity scheme which involved the erection of 2,984yd of 11 kV line. In this case, it is said, the cost of the supply to three farms would be met by the owner who presumably would recover it as a grant under the Hill Farming Act. The Electricity Board refused to accept a condition embodied in the consent of the Westmorland County Council that the full length should be underground. An inquiry was held in this case also but the result is not yet known.

Evidence was given on behalf of the Council at the Malvern Hills inquiry and the subsequent unsuccessful application for an injunction by the National Trust is referred to. Action was also taken in connection with the proposed erection of part of the 275 kV grid from Stella to Carlisle but the Ministry of Fuel and Power, after an inquiry, consented to the work in view of its national importance. Opposition to the North Wales hydro-electric scheme and to the siting of the Marchwood (Southampton) power station is also recorded.

Another section of the report deals with representations made to the General Post Office regarding telephone lines, call boxes, etc., and the question of lamp standard design is touched upon.

Royal Patronage for E.I.B.A.

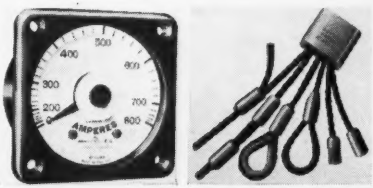
Her Majesty Queen Elizabeth II has been graciously pleased to grant her Patronage to the Electrical Industries Benevolent Association.

RECENT INTRODUCTIONS

NOTES ON NEW ELECTRICAL AND ALLIED PRODUCTS

Circular Scale Switchboard Instruments

SWITCHBOARD type moving iron ammeters and voltmeters ("C.K.A. Pattern") with 4in dials and 6·5in long, 240 deg circular scales are the latest additions to the range of instruments available from CROMPTON PARKINSON, LTD., Crompton House, Aldwych, London, W.C.2. In the case of voltmeters the resistances are mounted on the back of the instrument and protected by a moulded plastic cover. This prevents fogging of the glass due to heating but keeps the instrument self-contained. The minimum voltage range available is 0–30 V and the maximum 0–600 V and the maximum continuous overload is 125 per cent of full scale deflection. For ammeters, the minimum and maximum ranges are 0–1 and 0–20 A respectively while the maximum continuous overload is 150 per cent of full scale deflection.



Left: **Crompton Parkinson circular scale switchboard ammeter.** *Right:* **Various methods of employing the "Talurit" wire rope clamping system**

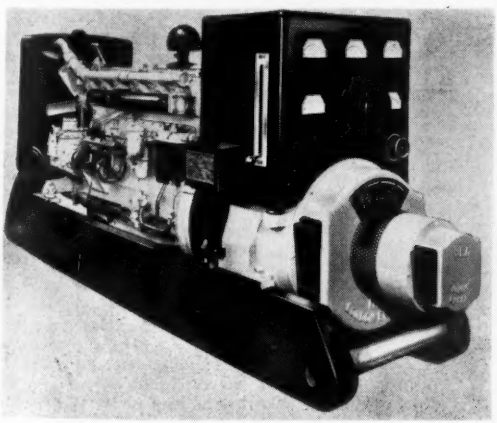
Wire Rope Clamping System

A wire rope clamping system which makes splicing unnecessary and at the same time saves both materials and labour has been made available by CABLE COVERS, LTD., Talurit Division, St. Stephen's House, London, S.W.1. Essentially it is a method of providing splices in wire ropes of all diameters up to 40 mm in the standard range and up to 60 mm when necessary by placing two thicknesses of the rope into the "Talurit" ferrule which is subsequently swaged in a press so that the ferrule and the two thicknesses of rope are moulded into one homogeneous mass occupying the same space as normally one thickness would do. The system has been thoroughly tested and it is found that under load the wire rope breaks first and the copper-free aluminium alloy ferrule remains intact.

Diesel Generating Plant

Recent additions to the range of diesel generating equipment made by HOUCHIN, LTD., Garford Street, London, E.14, include an 86 kW unit direct coupled to a Crossley BW6 130 h.p. diesel engine and a 93 kW set driven by a Dorman "6KA" series 145 h.p. engine, both machines running at 1,500 r.p.m. "HLD" BH 3/8 M alternators of the four salient pole, rotating field type are used in each case, operating at 0·8 power factor, subtropically rated.

Houchin 93 kW diesel generating set



The machines are of single bearing construction, with the rotor carried on a heavy duty roller journal in an end shield spigoted to the alternator frame. The driving flange is bolted direct to the engine flywheel, the alternator body being spigoted to the engine bell housing. The windings of the alternator, which is of all-steel design with a fully protected frame, are cooled by a large capacity circulating fan. The 2 kW 130 V d.c. exciter, which is built

on to the end of the alternator end shield, is separately fan cooled.

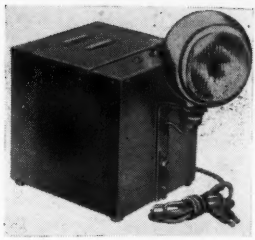
A notable feature is the saddle mounting of the sheet steel cabinet type control panel over the alternator on vibration dampers. This panel is complete with three ammeters, voltmeter, frequency meter, hand field regulator, and automatic voltage control gear with protective fuses on the instrument circuits. On the side of the panel is mounted a 200 A flush type h.v.c. combined switch fuse with on/off indicators.

Insulating Jackets

The range of "Calorsuit" insulating jackets which are now being marketed by T. F. CARRINGTON & Co., LTD., 161, Strand, London, W.C.2, fit all standard sizes of hot water cylinders and tanks but special jackets can be supplied at very little extra cost. The insulating material used has a thermal conductivity coefficient of 0·27 for a 1in thickness and is vermin proof. The covering is of high grade calico stitched with double seams and quilting which may be cut in order to fit round pipes, and special sections are also stitched so that cut-outs can be made to take immersion heater and thermostat heads. The jackets are made in two parts, one for the side and one for the top; this enables users to obtain additional heating in airing cupboards by removing the top section.

Automatic Emergency Lighting

Instant lighting in the event of mains failure, with extinguishing of the lighting and a return to battery charging on the restoration of the mains supply, is provided by the "Emy-lite" automatic emergency lighting made by AUTOMOBILE ELECTRICAL SPARES (MANCHESTER), 169a, Oxford Road, Manchester, 13. The apparatus is permanently plugged into the mains and 4–8 hours' light is available according to the output required. The float charging system keeps the battery in good condition and an indicator lamp shows that the unit is in working order.



"Emy-lite" automatic emergency lighting apparatus

Models are available for various voltages and outputs, floodlight and surgical units being included in the range.

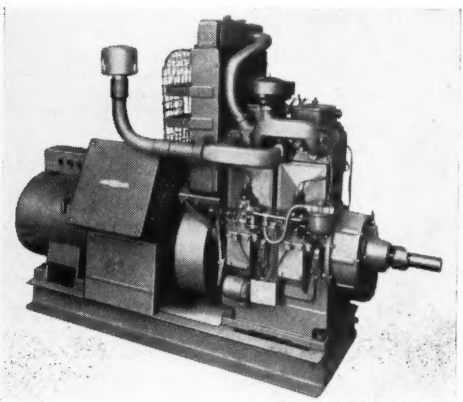
Diesel Lighting Sets

"Welcolite" fully automatic diesel lighting sets are now available from the WELLAND ENGINEERING CO., LTD., Water Lane, Spalding, in 3, 6, 10 and 15 kW sizes, water cooled, and 2·5 and 5 kW sizes, air cooled. The switching on of any light or power point in any part of the premises closes a circuit on a 24 V starter battery through a relay on the control panel. This energizes the decompressor and starter solenoids and sets the engine in motion. At about 40 r.p.m. a centrifugal switch cuts out the decompressor and starter solenoids and puts the engine under full compression.

Under these conditions the engine will run up to speed and as the voltage and frequency build up to 80 per cent of the maximum, the main contactor changes over to the alternator circuit.

As the last load is switched off the integrator relay comes out and makes contact through the centrifugal switch to the fuel stopping solenoid. When the engine comes to rest the circuit to the fuel stopping solenoid is broken and the circuit to the decompressor and starter solenoids is re-made.

In case of overload a thermal switch cuts off the supply. The battery circuit is time-lagged for 10–15 sec, after which cartridge fuses operate. The fuel tank is fitted with a low level micro-switch.



"Welcolite" 6 kW diesel lighting set

Commerce and Industry

Copper Price Increase

Ironmongers and Electrical Retailing

THE Ministry of Materials announces that from 15th June the price of electrolytic copper is increased from £231 to £281 per ton delivered to consumers' works. Discounts and premiums remain unchanged. The Ministry of Supply will make corresponding adjustments in the controlled prices of scrap and secondary metal. On 7th June the Ministry suspended sales of copper for delivery beyond the end of June. This suspension is now cancelled and consumers will again be able to buy up to their quotas for the current month and the month immediately following. The new price for copper takes into account changes in the world price. It also makes an allowance for the losses the Ministry has incurred through selling at £231 while its buying prices have been at much higher levels. Negotiations with the Ministry's main suppliers are still in progress.

Electrical Ironmongers

In the annual report of the Electrical Section of the National Federation of Ironmongers it is stated that as the Radio and Television Retailers' Association has implemented its decision to form a section known as the Electrical Appliance Dealers' Association, the Federation hopes that progress will be made with its proposal to form a joint council of associations acting for electrical retailers. The Electrical Section of the Federation is now engaged on collecting information on hire purchase interest charges which are being allowed by Electricity Boards and further action will be taken when the statistics are fully prepared.

A.E.M.T. Annual Meeting

The annual general meeting of the Association of Electrical Machinery Trades was held at the Holborn Restaurant, London, on 9th June. Mr. G. H. Holding (chairman), in reviewing the Association's activities during the past year, referred to the importance of training armature winders and electrical fitters. They were hopeful that they would be able to set down a course approved by the City & Guilds of London Institute and the Institution of Electrical Engineers. A special course of this kind would mean that a greater responsibility would devolve upon individual members of the Association in training youths for the industry. The co-operation of the City & Guilds of London Institute was encouraging.

The Association's policy for hire charges for electric motors and other equipment was laid down for the guidance of members, and was not formulated with the idea of dictating terms. Mr. Holding referred to the success of the recent convention, but although the attendance was good, he appealed for a still higher proportion of the membership. He mentioned that the annual ball would again be held at the Savoy Hotel on 7th November.

Mr. W. E. Lawton was re-elected president of the Association for the ensuing year and Mr. H. A. C. Hassall was elected chairman, Mr. J. Hardy vice-chairman and Mr. F. H. Washington treasurer.

Metal "Queen Cakes"

Research has shown that an oven which will bake queen cakes well will usually be perfectly satisfactory for cooking any other kind of food and so for many years the research laboratories of the General Electric Co., Ltd., have been using queen cakes for test baking. Now, however, in order to avoid the trouble of having to prepare real queen cakes for each experiment an imitation "queen cake" made of metal has been invented. Batches of these

Metal cakes being "cooked" in a G.E.C. oven

metal " cakes " are put into new ovens at various levels and at different temperatures. From the scientist's point of view, they have a big advantage over the real thing because sensitive temperature measuring instruments can be inserted in the " cakes " and as the oven warms up the heat received by each " cake " can be recorded. Thus, if the " cakes " nearer to the oven sides receive more or less heat than those farther in, this important effect can be detected.

The imitation cakes can be made with either a dull or a shiny surface. The dull cakes virtually absorb all the heat in the oven, whereas the cakes with a shiny surface use only the conducted heat, reflecting nearly all the radiant heat. By interchanging two such batches it was possible to prove whether cakes are baked by the heat carried through an oven in a stream of air, or whether they receive heat directly radiated from the hot electric elements. In this way it has been found that airborne heat plays the more important part, so that just as much care has to be taken in determining the size and position of the air vent in an oven, as in designing the heating elements themselves.

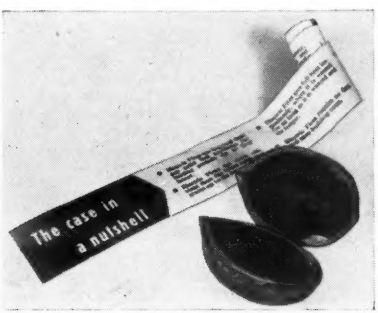
Miniature Circuit Breakers

Following the success of the demonstrations of their miniature circuit breaker in London and Glasgow recently, Dorman & Smith, Ltd., have arranged to give a further four demonstrations at the Chamber of Commerce, Birmingham, on 15th and 16th July next, dealing with the technical aspects and applications of their product. As on the previous occasions, invitations have had to be limited to the seating accommodation available, but a certain number of seats have been reserved for interested persons who should apply to the company's Manchester office.

Concisely Put

Simple ingenuity is the term for a " dodge " adopted by Berry's Electric, Ltd., to show that the electric fire is not so black as it is frequently painted. It takes the form of a small package containing a well-wrapped walnut shell which opens to reveal a little scroll. The phrase " The Case in a Nutshell " on the left of the scroll is followed by six reasons why the electric fire is desirable—fuel-saving and efficient for short-period heating; gives an immediate effect at the right place; economizes building costs; eliminates fuel-handling, dirt and consequent labour; and is safe and healthy in use.

The Berry nutshell



Electrical Instruction for Teachers

Three groups of teachers of housecraft in the London area recently attended the headquarters of the Electrical Association for Women for three consecutive weeks for courses of specialized electrical instruction. The lectures and practical work, based on the use of electrical appliances found in the home and in L.C.C. housecraft rooms, included such subjects as " The Economical Use of the Electric Cooker " and " Water Heating." The instruction was given by Miss M. E. Bailey, B.Sc., and Miss M. G. Reading, of the E.A.W. Housecraft Department. Further series are in course of preparation. Application should be made to Miss M. E. Bailey at 35, Grosvenor Place, London, S.W.1.

Registered Lighting Engineers

The 1952 list of those included on the Register of Lighting Engineers maintained by the Illuminating Engineering Society has just been published. It contains the names of over 200 members of the Society who satisfy the conditions of theoretical and practical training and have had a specified period of practical experience in the design of lighting installations. Copies of the list can be obtained on application to the Society at 32, Victoria Street, London, S.W.1.

Lighthouse Illumination

Referring to the note in our issue of 6th June upon the lighting installation at the new Leith Harbour lighthouse, Chance Bros., Ltd., inform us that the actual illumination of the lighthouse itself for navigational purposes is provided by a 500 W Siemens lamp (with a stand-by) in conjunction with a lens system supplied by Chance Bros.

Spheroidal Graphite Iron

One of the papers presented at the Fourth International Mechanical Engineering Congress, 4th–10th June, 1952, in Brussels, Belgium, was by Mr. A. B. Everest (Mond Nickel Co., Ltd.) which summarized from the engineer's point of view the latest information about the spheroidal graphite cast iron produced by the magnesium process. The properties were tabulated in order to explain how and why they were superior to those of other types of cast iron and of cast mild steel. The process was developed in the U.S.A. and the product is sometimes known as " nodular graphite cast iron."

The introduction of small proportions of magnesium under specified conditions modifies the graphite in the cast iron from the flake to the spheroidal form, which results in a substantial improvement of properties, the inherent qualities of the steel-like matrix being more clearly realized in the castings. The mechanical strength is at least doubled while such castings exhibit measurable ductility and their resistance to shock is increased several times.

The good castability of s.g. iron coupled with its interesting electrical and magnetic properties has already led to the use of this metal for making components of electrical machinery, such as motor frames, brush holders and switchgear parts. Some of the austenitic s.g. irons are non-magnetic and are of interest for making armature clamps, end rings and switchgear items in replacement of non-ferrous alloys and even non-magnetic steels.

Brush Coachwork Switching Production

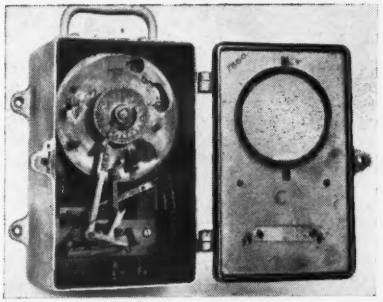
Brush Coachwork, Ltd., one of the companies in the Brush Aboe group, has already substantially reduced its production in order that space and labour may be made available for urgently needed electrical equipment for defence and to help combat power shortages. It is continuing the production of battery electric vehicles but will slowly cease building other vehicles. The change-over is being spread over a period so that all outstanding orders and commitments will be fulfilled. The great majority of production workers employed in making omnibus bodies and caravans will be trained for electrical and mechanical engineering work, and members of the administrative staff will be absorbed in the Brush Aboe group.

Conveyor Belt Vulcanizing

Since the publication by the National Coal Board, Production Department, of Information Bulletin No. 50/19, originally No. MM(50)4, describing the vulcanizing underground in coal mines of trunk conveyor belts, two of the machines therein described have been modified. Accordingly, a supplement to that bulletin now explains how the Harvey Frost flameproof vulcanizer has been changed. The control of heat by an energy regulator has been replaced by an adjustable thermostat incorporated in both the top and bottom platens. Conditions are also set out for governing the use of buffing machines, either electric or compressed air, which may now be used in the preparation of vulcanized joints for underground conveyor belts.

Long-Service Time Switch

After forty-two years of shop-window lighting service, a Venner time switch (although now withdrawn from service) is still ticking away merrily. It is an old C type switch intended for use on circuits up to 25 A at 250 V or 10 A on arc-lighting circuits up to 500 V.



Venner time switch with forty-two years' service

The switch is shown in the accompanying picture, and in the lower right-hand corner can be seen the two copper plungers, attached to a pivoted arm, which drop into the mercury cups to complete the circuit.

Prices of Materials

In the accompanying table we give the prices of the more important materials used in the electrical industry. The figures are those quoted on Monday last.

ALUMINIUM Ingots	ton £154 0s 0d
COPPER, H.C. Electro	ton £281 0s 0d
Fire Refined 99·70 per cent ..	ton £278 10s 0d
Fire Refined 99·50 per cent ..	ton £278 0s 0d
COPPER Tubes	lb 2s 8d
Sheet	ton £335 0s 0d
H.C. wire and strip	ton £313 10s 0d
LEAD, English	ton £130 10s 0d
Foreign	ton £129 0s 0d
MERCURY	flask £73 10s 0d
TIN	ton £974 0s 0d
ZINC, G.O.B. Foreign	ton £138 0s 0d
Electrolytic	ton £142 0s 0d
BRASS Tubes	lb 2s 3½d
Sheet	lb 2s 6½d
Wire	lb 2s 9½d
PHOSPHOR BRONZE	
Wire	lb 4s 1½d
RUBBER, No. 1 R.S.S. spot ..	lb 25½d–26d

Electrical Aids to Building

A demonstration of the use of powered hand tools for increasing productivity in building and reducing costs is to be given at the "Building To-day" Exhibition to be held at the Northampton College of Technology from 4th to 10th July.

Works Visits

Some sixty-five members of the Institute of Industrial Supervisors were the guests of Hoover, Ltd., at the Perivale factory on 7th June, when the London Section of the Institute held a one-

day conference, the theme of which was "The Foreman and Methods Improvement." The visitors were shown around the factory and had demonstrated to them examples of method improvement which had resulted in increased production.

Members of the Midland Branch of the Association of Mining Electrical and Mechanical Engineers toured the Bushbury Engineering Works of the Electric Construction Co., Ltd., Wolverhampton, on 11th June. The visit was arranged by Mr. J. Atherton, the secretary of the Branch, in conjunction with Mr. G. J. S. Drury, president of the Branch and the company's East Midlands district engineer.

Electrical Suggestions

In the monthly magazine of the Merseyside and North Wales Division of the B.E.A. are published some of the suggestions which were granted awards during the past year. They cover the replacement and utilization of wire ropes; automatic starting gear for drainage pumps; cleaning of boiler caps by use of sand blasting machine; and an angle iron crate for storing and handling 132 kV oil circuit breaker bushings.

Trade Announcements

Horton & Son (Surrey), Ltd., wholesalers, have moved to 53-55, Palmerston Road, Sutton. The telephone number is unchanged.

Thorn Electrical Industries, Ltd., announces changes in the "Atlas" lighting division. The sales offices and showrooms are at 233, Shaftesbury Avenue, London (telephone: Temple Bar 1599), with Mr. E. C. Wilson as commercial manager and Dr. H. H. Ballin as technical sales manager. A number of changes in the area sales organization, and of the Ferguson radio and television division sales organization, are also announced.

Xylonite's 75th Year

This year the Xylonite group of companies celebrate their seventy-fifth anniversary and to mark the event a well-produced and illustrated brochure has been issued in which the history of the group and some of the many present-day activities are recorded.

Annual Holidays

The factory of Wandleside Cable Works, Ltd., will be closed from 27th June until 14th July, during which time no deliveries can be accepted.

Bolton Contractors Complain

Members of Bolton Chamber of Trade feel that the North Western Electricity Board is taking an unfair advantage over private electrical contractors by sending out a card with the heading "Electrical Advisory Service." A member complained that one of his customers filled in a form asking for a new supply of electricity and had received a card in return. Members and officials felt that the practice was a dangerous one from the private traders' point of view. It was decided to write to the National Chamber of Trade.

In reply to the criticisms it was subsequently stated on behalf of the Board that the purpose of the cards was not to obtain electrical installation work. They were issued as a service to consumers and not just sent out when an application was made for a supply. People used them to ask for advice on a variety of subjects and in this way there was a considerable saving of time to the Board's staff by obviating unnecessary calls on consumers.

Furniture Manufacture

In the article which appeared in our last week's issue, illustration No. 1 (p. 1308) is not of a cross-cut saw, but a triple drum sanding machine.

Catalogues and Lists

George H. Scholes & Co., Ltd., Wylex Works, Wythenshawe, Manchester.—32-page catalogue of plugs, sockets and accessories (W.875).

Standard Telephones & Cables, Ltd., Connaught House, Aldwych, London, W.C.2. —Leaflet F/SRL.8 on low tension rectifiers and bulletin F/SRT.6 on single- and three-phase medium current rectifiers.

Linolite, Ltd., 118, Baker Street, London, W.1.—New leaflet, including price list, on "Linolite" decorative lighting fittings (D.10).

British Thomson-Houston Co., Ltd., Crown House, Aldwych, London, W.C.2.—"Mazda" lamp price booklet (L910).

Information Department

THE extensive records of our Information Department enable us to reply to most queries, but occasionally we ask for our readers' assistance in tracing names and addresses not known to us. We should be glad to have such information regarding the makers of the following:—

"Samson" toasters.

"Mainstay" trunking.

General inquiries from readers relating to sources of electrical goods, makers' addresses, etc., are replied to by the Information Department through the post. Inquiries should be accompanied by a stamped addressed envelope.

Engineering in Europe

Survey of Current Literature

THE protective equipment of the 150 kV line from Gösgen to Lavorgo, the length of which is 146 km, consists of a rapid distance protection of the rotating-field type with h.f. coupling and air-blast breaker. During the first year of its operation it had to clear several remarkable faults. Each of the distance relays at either end of the line protects 85 per cent of the latter in its basic time, i.e., it clears faults within 0·1 sec, thus 70 per cent of the line has a double protection, apart from the h.f.-coupling of the relays. Reclosing is therefore safely possible after 0·2 to 0·3 sec. The first breakdown described (of which oscillograms are given) was caused by a double-phase earth fault probably due to an atmospheric surge and was isolated at either end after 7 cycles and the total interruption with fault clearance and quenching of several arcs took 0·23 sec; the line is earthed through Petersen coils.

The second fault was due to a direct lightning stroke on to a 150/50 kV substation. The feeder circuit breaker was this time tripped manually, but the earth-fault arc was not quenched and the fault became a two-phase earth fault. The relays at either end then tripped within 0·1 and 0·2 sec, respectively. Reclosing occurred after about 20 sec. The fault then turned into an intermittent arcing earth causing breakdown of spark-gaps and also a transformer breakdown. Despite this complicated multiple breakdown the faults were eventually cleared and the line reclosed.

The third case reported again referred to a simple earth fault developing to a double earth fault, affecting by capacitive influence also the sound duplex line which partly runs over common masts. The arc could not be quenched during the tripped period but extinguished after reclosing. The protection worked in this way in all these severe cases without fail.—" Experience with Rapid Reclosing on the 150 kV Line Gösgen-Lavorgo," F. Schär, *A.S.E.-Bull.*, Vol. 43, No. 5, pp. 160–164, 8th March, 1952, in German.

Wind Power

A short survey of the various types of wind wheels used and of their characteristics in operation prefaces the discussion of the main fields of application of wind power. Of these, the use for pumping stations serving various purposes such as irrigation, drainage and drinking water supply for human consumption and for watering cattle, are well known and therefore only briefly indicated. The main interest nowadays is in electric power production which so far has been successful only on a comparatively small scale, and for good reasons. Tempting as the generation of power from inexhaustible supplies of energy is, the problem of obtaining a reliable and fairly constant output is a baffling one. Even the question whether d.c. or a.c. generation will in the long run be more favourable has not been solved unambiguously.

The article treats d.c. production and regulation circuits in greater detail than the problem of a.c. generation, because the former has on the whole been more successful and has the invaluable advantage of the use of storage batteries. This makes the supply more independent of the vagaries of the wind, although it is still necessary to regulate both the wind wheel and the generator circuit separately. The problem of a.c. generation, and mainly that of the operation of an existing system in parallel with thermal or hydro-electric power stations, is still in the experimental stage and is under investigation in many countries, although only a single station of large size ever worked successfully (in the Crimea, destroyed during the war and not yet rebuilt). A fair number of d.c. wind power stations of the types most popular in the United States, Germany, France, Denmark and Russia are described

Readers who require accurate full translations of any of the articles abstracted in this section can be put into touch with the translators who will supply them at current rates.—Editors, *Electrical Review*.

and illustrated.—" Modern Wind Power Utilization," G. R. Seidel, *Der Elektrotechniker*, Vol. 4, pp. 61–66, March, 1952, in German.

Circuit Breaker Arc Quenching

Despite the vast number of types of a.c. circuit breaker there are only a few general principles on which the quenching of the arc can be based. They are the lengthening (or drawing out) of the arc, deflecting it, cooling it and splitting it up into smaller arcs which are easier to quench. Whatever the system of circuit breaking, it is mostly a combination of some of these actions.

The most important agent used in oil circuit breakers, expansion and hard-gas circuit breakers is the hydrogen developed which is here, as in other fields, the best coolant available, and it also develops at a high pressure. The de-ionization of the break is not, strictly speaking, connected with arc quenching as such, but only the necessary condition against re-striking of the arc, yet it is a very important operation in a circuit breaker.

An initially surprising fact is that elaborate modern circuit breakers may easily handle currents of a high order and fail at low currents, so that special devices (or combinations of breakers) have to be used. This phenomenon particularly affects breakers of what is aptly called the " suicide-type," whose effect is proportional to the breaking current. Air-blast breakers work more or less on the flow principle and use the temperature difference between the arc and the air flow for cooling rather than the thermal conductivity of the air (which is incomparably lower than that of hydrogen). The modes of operation of the main types of modern circuit breakers are clearly described and contrasted in the article.—" Arc Quenching in A.C. Circuit Breakers," M. Zühlke, *E.T.Z.*, Vol. 73, No. 6, pp. 166–172, 15th March, 1952, in German.

Four-Phase Transmission

The economically favourable system two-wire-earth for three-phase transmission was not introduced in commercial systems because the sum of the currents in the overhead conductors is not zero, which makes them dangerous sources of interference. However, its advantages without its drawbacks are obtainable by converting it into a four-wire system. Such a system is supplied by a pair of star-delta connected transformers the stars of which are connected in parallel, whereas on the delta (line) side the a-phase of one of the transformers is connected to the c-phase of the other and earthed. The other four phases are connected to busbars or directly to the four-wire line.

The vector diagram of the resulting four-pointed star shows that the sum of the currents and voltages is zero, at least in no-load conditions. The distribution of the loads between the transformers, when the line is loaded, cannot be uniform because there is no voltage drop between the earthed phases of the transformers at the sending and receiving ends, but this may be corrected by reducing the transformation ratio by a change-over switch inserted into the earthed phases at the sending end, or by series compensation, split conductors, etc.

The voltages against earth will be $\sqrt{3}$ times higher than in the ordinary three-phase line, and the six line voltages will be unequal in pairs and, referred to the phase voltage U, be equal to U $\sqrt{3}$ U and 2 U respectively. The transmitting capacity is 2·25 times that of a three-phase line built with the same conductor weight and having the same specific losses. Alternatively, if transmitted power and specific losses are kept equal, 55·5 per cent conductor metal may be saved compared with a three-phase line.—" Four-Phase Power Transmission as a Means for Improving the Economy and Reliability of H.V. Systems," A. A. Filshtinskii, *Elektrichestvo*, No. 1, pp. 17–22, 1952, in Russian.

Structure of Metals

A SUMMARY of recent work in the crystallographic laboratory, Cambridge, is given by Dr. W. H. Taylor in Report Ref. N/T62 " X-Ray Studies of Metal Structures " (British Electrical and Allied Industries Research Association, Thorncroft Manor, Dorking Road, Leatherhead, price 6s). The report describes the stage reached in the development of a number of researches in which X-ray diffraction methods are applied to the examination of the textures and structures of metals. In every case, the new information obtained is of fundamental interest for the fuller understanding of some aspect of the problems of metal physics; but, in addition, all the projects discussed are at least potentially important because of their bearing on some material or process of technical interest.

ELECTRICITY SUPPLY

Output Again Lower in May

Lighting Conversion at Bournemouth

ELECTRICITY generated last month again showed a decline compared with the corresponding month of last year. The Ministry of Fuel and Power statement for May records that the British Electricity Authority, the North of Scotland Hydro-Electric Board and the Lochaber Power Co. together produced 4,624 million kWh compared with 4,775 million kWh in May, 1951, a decrease of 151 million kWh or 3·2 per cent. The reduction is slightly less than in the previous month when the total of 5,015 million kWh was 4 per cent less than in April, 1951. The rate of increase in output so far this year is only 1·9 per cent, compared with 13·7 per cent for the similar period of 1951. The installed plant capacity at 16,615 MW is 9·2 per cent above the total available a year ago. New plant installed by the B.E.A. during the past month has included a 50 MW Parsons set and a 300,000 lb/hr Babcock & Wilcox boiler at Braehead and a 60 MW Parsons set at Keadby.

	Fuel consumed Thousand tons		kWh generated Millions			kWh sent out Millions	Installed capacity (m.c.r.) MW
	Coal	Oil	Steam	Water power	Total*		
British Electricity Authority ..	2,217	2·5	4,478	19	4,503	4,229	15,972
North of Scotland	17	1·1	25	92	121	120	643
Total for May, 1952	2,234	3·6	4,503	111	4,624	4,349	16,615
Corresponding total for May, 1951	2,744	6·9	4,657	103	4,775	4,501	15,212
Increase or decrease, per cent ..	−18·6	−47·8	−3·3	+7·8	−3·2	−3·4	+9·2
Total for year to date (5 months) 1952	14,686	30·3	26,270	786	27,125	25,591	
Total for corresponding months of 1951	15,247	44·8	25,893	643	26,625	25,161	
Increase or decrease, per cent ..	−3·7	−32·4	+1·5	+22·2	+1·9	+1·7	

* The total figure includes 6·5 million kWh generated by oil engines and 3·6 million kWh by waste heat plants in May, 1952.

York Power Station Extensions

Plans have been submitted to York Council by the British Electricity Authority for the proposed extensions to the generating station at Foss Islands Road.

Start on New Schemes

Work has begun on the site of the new Hams Hall "C" generating station, near Birmingham, the first section of which is expected to be in operation in 1956. Another power station project also just commenced is that on the outskirts of Wakefield. Before excavation was started, according to the local press, it was necessary for 24 acres of growing wheat to be cut.

Street Lighting at Bournemouth

Bournemouth Highways and Works Committee has instructed the borough engineer to investigate the possibility of converting the existing gas lamps and to report on the economies that may be effected with a view to the future use of electricity for lighting by-roads.

Overhead Line Approved

A plan for erecting an overhead line to supply electricity to three farms in the Martindale area of Westmorland has been approved by the Ministry of Fuel and Power. An inquiry into the scheme was held last July when there was opposition from Westmorland County Council. The North Western Electricity Board said the overhead line would cost £1,455 but an underground cable would cost nearly £7,000.

Cable Laying Plans

The Eston (Yorks) Urban District Council has approved plans by the North Eastern Electricity Board for the laying of 11 kV underground mains for supplying electricity to Dorman Long & Co., Ltd., the Redcar Road housing estate, South Bank, and for the reinforcement of the network in the Eston–Normanby area.

MANCHESTER POWER STATION JUBILEE

Efficient Generation at Stuart Street

AFTER fifty years' operation, Stuart Street power station, Manchester, is still one of the most efficient stations in the country. It is consistently included in the "league table" of the best twenty stations in the country and, in the latest returns for the North West it has the best figure for fuel cost per kWh sent out and the second highest thermal efficiency.

The site was purchased by the Manchester Corporation in 1898 and the station was officially opened on 27th May, 1902. The original installation comprised six 1,500 kW steam reciprocating engine driven fly-wheel alternators and 24 B. & W. boilers. Even before the station was opened, arrangements were in hand for the installation of a further two sets of 3,750 kW capacity, the buildings to be large enough to accommodate two additional similar sets; i.e., a total site capacity of 24,000 kW. The plant now in commission on the same site is of 175,000 kW rating.

In 1934 a modernization scheme was adopted which included the removal of all plant from the second half of the station and the installation of three 30,750 kW and one 25,000 kW sets and 12 Thompson chain grate stoker-fired boilers, all of which were accommodated within the original building shell.

It had been evident for some time that the switchgear was incapable of dealing with the possible fault kVA on a system which now included a large station—Barton. The original voltage of distribution from Stuart Street was 6,600 V and because of the large number of feeders concerned it was decided to continue distribution at that voltage. The problem of devising suitable switchgear and a switching scheme to deal with 180,000 kW at 6,600 V was an unusual one and involved the development by the manufacturers of switching units having a rating of 3,000 A. The contract for switchgear was the largest that had hitherto been placed in the country and included a number of novel features, one of which was separate automatic voltage control of groups of distributors, about 60 circuits being involved. The whole work of demolition and installation of turbos, boilers and switchgear was completed without either diminution or interruption of supply.

Post-War Development

Towards the end of the last war plans for the future development of the Greater Manchester supply system were considered; there was a load of 145,000 kW within an area of two miles radius of Stuart Street, and coal was readily available. A decision was made to install a 60,000 kW Metrovick set generating at 33 kV together with two John Thompson/International Combustion 400,000 lb/hr boilers with pulverized fuel firing. This necessitated the removal of old boilers, turbine plant, switchgear, etc., and the demolition of the original half of the station of which no drawings were available, consequently some awkward problems had to be dealt with as site work progressed. Two chimneys were removed and one new chimney built to take gases from the new boilers and half the boilers in No. 2 section. Site conditions necessitated the unusual position of the chimney between boilers and turbine. The framework of the boiler house is of the portal type to give a clear boiler house.

Coal Direct from Colliery

Stuart Street station has the advantage of being less than a third of a mile from Bradford Colliery but because of the crowded surface transport conditions it obtained its coal supplies from other sources. The decision to proceed with a large extension of the station made the possibility of using slack coal from Bradford Colliery seem sufficiently attractive to justify another attempt to solve the transport problem. This resulted in negotiations for the installation of an underground conveyor system between the two points. Stuart Street is the first station in Great Britain to be bunkered by conveyor direct from the pit. The tunnel, approximately 10ft in diameter and built in a way similar to the London tube railway, is of sufficient width to accommodate a 36in conveyor belt, and a 1ft 6in rail track for tubs. The conveyor, which is capable of transporting 200 tons/hr, is 717yd long. The scheme is of advantage both to the Colliery and the generating station, for not only does Stuart Street obtain dry coal well suited to its needs, but the Colliery has a steady outlet for a grade of fuel which is otherwise difficult to dispose of with profit.

The changes since the station was first opened have been spectacular but none more so than the change in boiler capacity. The original station produced 9 MW on 24 boilers; the new set has actually carried 42 MW on one.

Sir Leonard Pearce was responsible for the initial change from reciprocating engines to turbines. Subsequent development was conceived and dealt with by Mr. H. C. Lamb, chief engineer and manager, Manchester Corporation Electricity Department, and his assistant Mr. W. Kidd.

To commemorate the jubilee the B.E.A. North Western Division arranged a programme during the current week which has included tours of the station by employees and their families, film shows, sports events and a concert.

FINANCIAL SECTION

Company Notes and Stock Exchange Activities

Reports and Dividends

Hectrae, Ltd.—The annual general meeting will be held on 4th July. In his circulated statement, Mr. C. H. Smith (chairman) says the turnover for the year under review was substantially higher than that of the previous year, with an increased rate of gross profit, largely because of the development of their business in industrial apparatus and in spite of the continuation of purchase tax at an excessively high rate on electric water heating apparatus, which was at one time their main activity. Among new lines of manufacture were steam and electric fuel and lubricating oil heaters for use aboard ship, in power stations and large works, special large power immersion heaters for industry, electrically heated drying ovens, electric water and air heaters for railway rolling stock, and a comprehensive range of flameproof electric heaters for use in hazardous positions. Useful orders for electric water heaters have been received from overseas, resulting in a substantial increase in export trade. Many Government contracts are in hand, particularly from the Admiralty. The exorbitant rate of taxation made it impossible to carry to reserve a substantial proportion of profits to finance future developments.

The British Electric Traction Co., Ltd., reports a group net profit for the year to 31st March last, after providing £960,027 for taxation, of £1,176,375, as compared with £1,211,426 for 1950-51. The proportion attributable to the parent company is £1,054,484 (against £1,085,748), and after deducting profits retained by subsidiaries, the net profit of the parent company is £654,883 (£639,247). The dividend on the deferred and "A" deferred ordinary stock for the year is maintained at 25 per cent, and £257,886 is carried forward (against £235,942 brought in).

Drake & Gorham, Ltd., report a group profit for the period 4th April, 1951 to 31st March last, subject to audit, of £25,018, after taxation of £52,212. This compares with a loss of £5,857 for the period 1st July, 1950 to 3rd April, 1951. It is proposed to pay a dividend of 5 per cent (unchanged).

Enfield Cables, Ltd.—At the annual meeting held on 11th June a stockholders' committee of four was appointed to receive the investigating accountants' report and to make such recommendations as thought fit.

New Companies

Electricraft Services (Leicester), Ltd.—Registered 29th May. Capital £750. To acquire the business of electrical traders carried on by Alan W. Bentley and G. K. Exon at 156, Brunswick Street, Leicester. Directors: A. W. Bentley and G. K. Exon. Solicitors: Tate & Powell, Leicester.

Edwards Electrical Co., Ltd.—Registered 28th May. Capital £1,000. Electrical engineers, etc. Directors: A. F. Toms and Mrs. Mary K. Toms. Regd. office: 251, Old Street, E.C.1.

Richardsons Westgarth (Hartlepool), Ltd.—Registered 29th May. Capital £1,000. Marine, mechanical, electrical and general engineers, manufacturers of marine, land and other engines, etc. Directors: O. J. Philipson, Sir Summers Hunter, T. P. Everett and W. E. Loveridge. The last three mentioned are all directors of Richardsons Westgarth & Co., Ltd. Regd. office: Northumberland Engine Works, Wallsend, Northumberland.

Telecom Services, Ltd.—Registered 3rd June. Capital £500. Electrical equipment specialists, repairers, service and maintenance engineers, manufacturers of and dealers in and hirers of telecommunication, radio and television equipment and electrical and mechanical apparatus of all kinds, etc. Directors: A. F. Trinder, S. L. McCrerie and W. Hastings. Regd. office: 2a, Barking Road, E.16.

Houghton's (Hall Green), Ltd.—Registered 3rd June. Capital £1,000. Manufacturers and repairers of and dealers in wireless and television sets, artificial lighting apparatus and electrical fittings, etc. Directors: J. A. Houghton and Margaret Houghton. Regd. office: 1514, Stratford Road, Hall Green, Birmingham, 28.

Rotary Electrical Co., Ltd.—Registered 3rd June. Capital £5,000. To acquire the business of electrical and mechanical engineers now carried on by P. R. Street at Spring Street, Sheffield. P. R. Street is chairman and managing director. Solicitors: Elliott & Slater, 12, Paradise Square, Sheffield.

Spiroto Regulators, Ltd.—Registered 11th June. Capital £500. To carry on the business of manufacturers and sellers of voltage regulators in accordance with the inventions the subject of British Letters Patent Nos. 637,634 and 671,694 or either of them, etc. Directors: M. Rosenfeld, director of Brentford Transformers, Ltd., and C. A. Barber,

director of Car & General Radio, Ltd., etc. Secretary: C. A. Barber. Regd. office: 2, Finchley Road, N.W.8.

Kenton Electrical Installations, Ltd.—Registered 3rd June. Capital £500. Electricians, electrical and mechanical engineers, etc. Directors: G. D. Costin and E. C. Costin. Solicitors: J. H. Lambert & Co., 310-312, Regent Street, W.1.

Henry A. Patterson & Partners, Ltd.—Registered 9th June. Capital £1,000. Electrical wholesalers, merchants, fitters, factors, maintainers and repairers of electrical apparatus and accessories, etc. Directors: H. A. Patterson and Gwendoline E. Patterson. Regd. office: 19, Dunraven Street, W.1.

Casella (Electronics), Ltd.—Registered 10th June. Capital £4,000. Manufacturers and dealers in electronic and mechanical testing, measuring, surgical, medical, laboratory and scientific instruments, etc. Directors: R. P. Abraham (chairman); E. W. Meyer and A. S. Greenwood, both directors of C. F. Casella & Co., Ltd.; and D. A. Herbert. Secretary: Duncan A. Herbert. Regd. office: 24, Coleman Street, E.C.2.

Bankruptcies

Kirkstall Radio & Electrical Service (a firm), Kirkstall Lodge, Edwinstowe, Notts, radio and electrical engineers.—Receiving order made 30th May on a creditor's petition.

M. C. Usher, 31, Ranelagh Garden Mansions, Hurlingham, S.W.6, electrical contractor and decorator.—Receiving order made 9th June on a creditor's petition.

R. J. Slinger, lately carrying on business and residing at 55, Moor Lane, Great Crosby, Liverpool, and now residing at 15, July Grove, Litherland, Liverpool, 21, electrical engineer.—Receiving order made 9th June on a creditor's petition.

R. H. Winslade, 7, Collingwood Mount, Portsmouth Road, Camberley, Surrey, electrical engineer.—Public examination 7th October at the Guildhall, Guildford. (Amended notice.)

A. J. Coles, 424, Pinner Road, Harrow, Middx, electrical engineer and contractor, lately carrying on business at 2a, Pinner Road, Harrow.—Application for discharge to be heard on 25th July at the Court House, Town Hall, St. Albans.

C. Welbourn, residing at 227, Hykeham Road, Lincoln, now an engineer, formerly residing and carrying on business at 158, Hykeham Road, Lincoln, as an electrical engineer and contractor.—Trustee, Mr. G. H. Kelsey, 340, High Street, Lincoln, released 19th May.

F. Taylor, 4, Mercer Court and 46, Fenwick Street, both in Liverpool, electrical and general contractor.—Trustee, Mr. P. S. Booth, 5, Rumford Place, Liverpool, 3, released 23rd May, 1952.

S. H. Ireland and **V. Thomason,** carrying on business in co-partnership under the style of Ireland, Thomason & Co. at 61, Market Place, Malton, and also at 110, Willowgate, Pickering, Yorks, electrical contractors and radio engineers.—Last day for receiving proofs for dividend 28th June. Trustee, Mr. R. B. Smith, 3, Alfred Street, Leeds, 1.

Conditions in Indonesia

PROSPECTS for British exporters are dealt with in "Review of Commercial Conditions in Indonesia," published for the Board of Trade by H.M. Stationery Office at 2s 6d net. After outlining the pre-war conditions in Indonesia, the report reviews its post-war economy and the market for United Kingdom goods. Before the war the chief supplying countries were the Netherlands, Japan, the United States, Germany and the United Kingdom, in that order. With the defeat of

Commodity	*Kilograms*	*Rupiahs*
Dynamos, electric motors, transformers and static convertors	1,667,577	7,137,041
Batteries (dry) for torches and bicycle lamps	812,494	1,298,692
Electric batteries and accumulators: other	1,090,468	2,442,417
Electric bulbs (except for automobile lamps)	147,366	1,006,981
Electric bulbs for automobile lamps	10,988	140,972
Apparatus for telegraphy, telephony and television (except wireless sets for domestic use)	312,767	5,416,933
Radio apparatus: receiving sets	157,132	1,744,424
Insulated cables and wire for electricity (excluding wire made to measure, cords with plugs)	2,985,620	6,493,275
Insulators, articles of insulating materials, installation tubes and fittings	1,144,319	1,476,534

both Germany and Japan a larger proportion of Indonesian imports came from the United States and the United Kingdom, the former assuming first place and the latter rising from fifth to fourth place. Japan lagged behind for a time, but by the end of 1950 held third place. The report states that the United Kingdom will have to fight hard to maintain the larger share which came her way after the war. Indonesia is ready to buy from the United Kingdom, but keen competition will ensure that prices and delivery periods will be carefully examined. Opportunities should occur for the supply of capital goods in connection with the country's industrialization schemes, and with the restoration and expansion of railways, roads, harbours and telephones. The following table shows the value of the principal electrical imports in 1950. (10·64 rupiahs = £1 sterling.)

STOCKS and SHARES

SOBER behaviour has characterized most sections of the Stock Exchange since last week's pronouncements by the Prime Minister and the Chancellor of the Exchequer concerning the progress of national affairs and the state of the gold and dollar reserves. Mr. Butler's phrase that we are "holding the position" describes, also, the recent state of the Stock Exchange markets. Tendencies are still on the easy side, but it is satisfactory to see few and generally insignificant changes in the price-lists this week, in place of the sharper falls which have too often been appearing there in preceding weeks. Matters seem to have reached the stage where confidence in an eventual turn for the better is firm enough to deter the selling of good securities at to-day's prices, but not yet so strong as to induce investors to "emerge from their shells" at a still admittedly critical stage of events.

New Issues

The prospective yield of over 8 per cent on Allen West new 5s ordinary shares has been attracting investment attention, with the result that the premium on the issue price of 8s hardened from 6d, in initial dealings, to about 1s 3d. The shares are still available free of transfer stamp to the buyer, and will be so, in the form of renounced allotment letters, until the middle of next month. The call of 8s per share was due for payment to-day, Friday, after which the selling of "rights" could be expected, in the ordinary course of events, to slacken. A call of 7s 6d falls due to-day on Henley's Telegraph new £1 ordinary shares; a further 7s remains to be paid on 25th July, after which it is the intention to distribute a 100 per cent capital bonus on all the ordinary shares then issued. At a premium of 3d the new shares are on a yield basis of 6¾ per cent.

Preference Shares

News affecting the outlook this year for company earnings, and, consequently, for ordinary shares, continues to divert a good deal of investment attention to well-entrenched preference shares, of which the supply has become by no means plentiful. Therefore it may again serve a purpose to mention some of the preference issues at present on offer, in fair numbers, in the electrical equipment market. E. K. Cole 5½ per cents and Christy Brothers 5 per cents have lately been available at respective prices of 20s and 18s 3d, to yield 5½ per cent in each case. The 5 per cent preference shares of Reliance-Clifton and Thorn Electric, both at 18s, pay £5 11s 1d per cent. On Laurence Scott 4½ per cents at 16s, and on G.E.C. 6½ per cents at 24s 6d, the yield is 5·3 per cent. Cossor "sixes" at 18s 3d give over 6½ per cent, and British Thermostat 4½ per cents, at 16s 6d, 5·4 per cent. Many of the popular shares show less than 5 per cent return on money invested in them at to-day's prices. In comparison, War Loan is currently quoted to yield a little under 4¾ per cent.

Coming Results

The Hackbridge & Hewittic Company's results for the financial year ended last March are due about now. Made public in 1947, the company has so far reported increased profits and a moderate rise in the ordinary dividend for each successive year. Last year's total of 18 per cent came out of earnings equivalent to 51 per cent on the £500,000 ordinary capital, and at the annual meeting the chairman referred to substantial orders on hand for rectifier equipment in this country and abroad. The Hackbridge Cable Company's year also finished in March: the final dividend and preliminary profits statement were announced last time in August.

Dewhurst Dividends

Dewhurst & Partner distributed a two-for-one share bonus between last year's interim dividend of 10 and the final of 12½ per cent. Last month, an interim of 4 per cent was declared in respect of the year ending next September. Since both of the last two payments applied to the present ordinary capital of £180,000, a total dividend of 16½ per cent is regarded by the market as the appropriate basis for yield calculations. It cannot properly be taken as firm in advance of the next final dividend decision, but at the price of 4s 6d, at which a moderate line of the 2s shares has lately been on offer, the indicated return is 7½ per cent on the money. According to the last annual report, new premises will be in occupation by the company during the current year, although the benefits are not expected to appear until later.

Dictograph Telephones

The interim dividend declared last month by the Dictograph Telephones Company was a repetition of the 10 per cent payments made on the three previous occasions, followed each time by an equal final distribution, making a 20 per cent total. Since 1945, the ordinary distribution has been raised by stages from 11 per cent. The latest net profits, after tax, of £57,000, represented earnings of about 45 per cent on the £250,000 ordinary capital, allowing for the dividend on £100,000 5 per cent preference stock. Last year's report recorded a 30 per cent expansion in the volume of business, and was followed by an issue of ordinary shares at 4s, to raise nearly £50,000 new capital. The shares are quoted at 4s 9d to yield 8 guineas per cent on a 20 per cent distribution.

Electrical Investments

Past Week's Price Changes

Company	Dividend Previous	Dividend Last	Middle Price June 16 1952	Week's Rise or Fall	Est. Yield p.c. £	s	d
Gilt-edged and Overseas Stocks							
Brit. Elec. 1968/73	3	3	81	—1	3	14	1
Brit. Elec. 1974/77	3	3	80	—1	3	15	0
Brit. Elec. 1976/79	3½	3½	86	—1	4	1	5
Brit. Elec. 1974/79	—	4½	99	—	4	5	10
Calcutta Elec. ..	6†	6†	19/3	—	6	4	8†
East African Power	7	7	26/-	—	5	7	8
Nigerian Elec. ..	10	10	20/9	—6d	9	12	10
Palestine Elec."A"	5†	5†	13/6	—	7	8	2†
Perak Hydro-Elec.	Nil	Nil	11/6	—		Nil	
Equipment and Manufacturing							
Aberdare Cables(5/-)	20	20	10/9	—	9	6	0
Aerialite (1/-) ..	83½	88½	7/9	—	11	7	0
Aron Elec. Ord. ..	15	15	32/6	—	9	4	8
Assoc. Elec. Ord.	20	20	69/6	—	5	15	2
Automatic Tel.& El.	15	15	55/-	—	5	9	1
Babcock & Wilcox	18	18	60/9	—6d	5	18	6
Baldwin, H. J. (2/-)	25	25	4/9	—	10	10	6
Bakelite (10/-) ..	—	—	18/3	—		—	
British Aluminium	10	12	37/9	—	6	7	0
B.I. Callender's ..	7½	9	29/3	—	6	3	0
British Thermostat (5/-)	30	30	24/6xd	—1/6	6	2	5
British Vac.Cleaner (5/-)	25	25	12/6	—9d	10	0	0
Brook Motors ..	20	20	32/-	—	6	5	0
Brush Ord. (5/-) ..	10	10	4/6	—	11	2	2
A. F. Bulgin (1/-)..	27½	30	2/9	—	10	18	2
Burco (5/-) ..	42½	38¾	18/9	—	10	6	8
Chloride El.Storage	15	15	56/3	—	5	6	9
Cole, E. K. (5/-) ..	20	25	14/-	—		—	
Cossor, A. C. (5/-)	Nil	Nil	10/6	—		Nil	
Crabtree (10/-) ..	17½	17½	31/-	—	5	13	0
Crompton Parkinson Ord. (5/-) ..	11½	11½	8/6	—	6	12	3
De La Rue (5/-) ..	50	50	10/9	—3d	11	12	6*
Decca (1/-) ..	112½	112½	15/-	—6d	7	9	4
Dewhurst (2/-) ..	35	22½*	4/6	—		—	
Dictograph Tel. (2/-)	20	20	4/9	—	8	8	6
E.M.I. (10/-) ..	8	12	13/9	—3d	8	14	6
Electrical Components (5/-) ..	20	20	10/-	—	10	0	0
Elec. Construction	15	15	47/6	—	6	6	4
Enfield Cable Ord.	7½	7½	19/-	—	7	17	10
English Electric ..	15	15	51/6	—	5	16	6
Ericsson Tel. (5/-)	22†	22†*	34/3	—	3	4	3†
Ever Ready (5/-)	35	35	22/-	—6d	7	19	0
Falk Stadelmann	15	15	35/9	+3d	8	7	10
G.E.C. Ord. ..	17½	22½	76/-	—	5	18	6
General Cables (5/-)	30	30	12/6	—	12	0	0
Greenwood & Batley	15	15	40/-	—	7	10	0
Hackbridge Cable (5/-)	20	20	9/9	—6d	10	5	2
HackbridgeHewittic (5/-)	15	18	14/-	—6d	6	8	7
Hall Tel. Acc. (10/-)	10	10	10/-	—	10	0	0
Heatrae (2/-) ..	12½	12½	4/-	—	6	5	0
Henleys (5/-) ..	20	20	15/3	—	6	11	2
Holophane (5/-) ..	15	15	8/3	—		—	
Hoover (5/-) ..	37½	35*	23/-	—6d	7	12	2

Company	Dividend Previous	Dividend Last	Middle Price June 16 1952	Week's Rise or Fall	Est. Yield p.c. £	s	d
Equipment and Manufacturing (continued)							
Intl. Combustion (5/-)	20	25	20/6	—	6	2	0
Johnson & Phillips	15	15	47/6	—	6	6	3
Lancashire Dynamo	22½	12½*	40/-	—	6	5	0
Laurence,Scott(5/-)	12½	15	12/3	—	6	2	6
London Elec. Wire	10	12½	42/6	—	5	17	8
J. Lucas	17½	7½*	29/6	—	5	1	9
Marryat & S. (2/-)	—	22½	5/-	—	9	0	0
Mather & Platt ..	12½	12½	38/3	—½	6	10	9
Metal Industries ..	10	10	36/-	+6d	5	11	1
Mid. Elec. Mfg. ..	15	15	55/-	—	5	9	0
Murex	10	12½	45/-	—½	5	11	1
Newman Ind. (2/-)	6	10	2/9	—	7	5	6
Oldham & Son (1/-)	30	30	4/3	—	7	1	3
Parnall (Yate) (5/-)	5	6	3/-	—3d	10	0	0
Parsons, C. A. ..	15	10*	47/6	—	4	4	3
Plessey (5/-) ..	20	22½	17/-	—	6	12	4
Pye Deferred (5/-)	35	18*	15/6	—	5	16	3
Revo (10/-) ..	27½	27½	33/9	—	8	3	0
Reyrolle	15	10*	41/-	—1/-	4	17	7
Scot. Cable (4/-) ..	30	30	19/-	—3d	6	6	4
Siemens Ord. ..	10	10	31/3	—	6	8	0
Strand Elec. (5/-)..	17½	17½	8/3	—	10	12	2
Sturtevant (5/-) ..	16½†	17¼*†	22/-	—		—	
Switchgear & Cowans (5/-)	22½	22½	15/-	—	7	10	0
Taylor T. (5/-) ..	20	20	20/-	—	5	0	0
T.C.C. (10/-) ..	20	20*	36/3xb	—		—	
T.C. & M. ..	10	10	31/3	—	6	8	0
TelephoneMfg.(5/-)	10	10	7/9	—3d	6	9	0
Thorn Elec. (5/-)..	20	10*	7/9	—	6	9	0
Tube Investments	25	25	49/6	—		—	
Vactric (5/-) ..	Nil	Nil	4/3	—3d		Nil	
Veritys (5/-) ..	Nil	7½	3/9	—	10	0	0
Walsall Conduits (4/-)	70	70	46/3	—	6	1	0
Ward & Goldstone (5/-)	44	45*	36/3	—	6	0	0
Watford (2/-) ..	25	25	6/-	—	8	6	8
Westinghouse Brake	14	14	45/-	—	6	4	6
West, Allen (5/-)..	12½	15	8/9	—	8	11	6
Trusts, Transport and Communications							
Anglo-Am. Tel.: A Ord.	—	4½	77½	—5	5	16	3
Ord.	—	56/3	55	—	5	2	3
Anglo-Portuguese	8	8	20/6	—6d	7	16	2
Brit. Elec. Traction: Def. Ord. ..	22½	25	365	—	6	17	0
Cable & Wireless: Ord.	6	8	111½	—	7	3	6
4% Loan ..	4	4	96	—	4	3	4
Calcutta Trams ..	6†	6†	21/-	—	5	14	3†
Cape Elec. Trams	4	5	12/6	—	8	0	0
Marconi Marine ..	7½	10	27/6	—	7	5	6
Oriental Tel. Ord.	16	16	50/-	+½		—	
Telephone Props.	7	8	28/9	—	5	11	4
Tele. Rentals (5/-)	10	10	8/3	—	6	1	3

* After capital bonus.
† Dividends are paid free of Income Tax.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (2s 8d each including postage) will be obtainable after 30th July from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1945

6840. Aldis Bros., Ltd., General Electric Co., Ltd., Aldis, A. C. W., and Francis, V. J.—Lamp-signalling apparatus. 18th October, 1949. (676611.)

1947

21634. Brennan, J. B.—Electrolytic devices. 7th August, 1947. (676511.)

21696. Sylvania Electric Products, Inc.—Electric discharge lamp. 7th August, 1947. (676617.)

26671. Western Electric Co., Inc.—Method of, and apparatus for, inducing conductivity in insulators. 3rd October, 1947. (676411.)

1948

6129. Radio Corporation of America.—Calculating electron discharge device. 27th February, 1948. (676622.)

12635. British Thomson-Houston Co., Ltd.—Magnetron apparatus. 7th May, 1948. (676742.)

13572. Soc. Anon. des Manufactures des Glaces et Produits Chimiques de St.-Gobain, Chauny, & Cirey.—Electric furnaces for the treatment of materials such as glass. 19th May, 1948. (676413.)

13575. Tunnicliffe, E. A. J.—Apparatus to control the intensity of illumination by tubular lamps in a photographic negative viewing apparatus. 20th June, 1949. (676414.)

23995. Gilfillan Bros., Inc.—Single scope two-co-ordinate radar systems. 13th September, 1948. (676743.)

29781 and 29783. Western Electric Co., Inc.—Bombardment induced conductivity devices. 16th November, 1948. (676424/5.)

30570. Pye, Ltd., and Cope, J. E.—Television cameras. 23rd November, 1949. (676517.)

30571. Pye, Ltd., and Weighton, D.—Television cameras. 23rd January, 1950. (676518.)

31514. Standard Telephones & Cables, Ltd., and Eaglesfield, C. C.—Connecting arrangements for electron discharge devices. 6th December, 1948. (676623.)

32493. Power Jets (Research & Development), Ltd., and Martin, P.—Absorption dynamometers. 26th November, 1949. (676624.)

1949

6524. Electrolux, Ltd.—Thermostats. 10th March, 1949. (676524.)

9632. Metropolitan-Vickers Electrical Co., Ltd.—Direct current measuring, indicating, and control circuit arrangements. 26th May, 1950. (676693.)

10383. Goodmans Industries, Ltd.—Focusing devices for cathode-ray tubes. 31st March, 1950. (676629.)

10776. Stewart, Ltd., C., and Henderson, S. G.—Preparation for the production of electrical insulating layers on metal. 22nd April, 1949. (676694.)

12732. Compagnie Générale de Télégraphie sans Fil.—Thermionic valve arrangements. 12th May, 1949. (676630.)

14872. Marconi's Wireless Telegraph Co., Ltd.—Variable ultra-high-frequency circuits. 2nd June, 1949. (676698.)

15477. Faulkner, H.—Electrically-operated lighters. 22nd March, 1950. (676434.)

16118. Associated Electrical Industries, Ltd.—Microscopic examination by interferometry of transparent objects. 8th May, 1950. (676749.)

16216. Muller, A., and Brutsch, L. (trading as Brutsch & Co.).—Device for regulating the speed of fractional horsepower electric motors. 17th June, 1949. (676637.)

16577. Research Corporation.—Electrical precipitators. 22nd June, 1949. (676638.)

16906. Electric & Musical Industries, Ltd.—Television tubes and mountings therefor. 26th June, 1950. (676639.)

23521. British Thomson-Houston Co., Ltd.—Brush holder assemblies. 12th September, 1949. (676443.)

23983. Davidson, A. D., and Scammell, E. W.—Automatic cut-outs for electrically-heated appliances. 18th September, 1950. (676702.)

24504. Hollins, J. R.—Selector switch for signalling arrangements for use on vehicles. 23rd September, 1949. (676539.)

26630. Brodrick, A. H. B.—Electrical capacitors. 10th January, 1951. (676707.)

27247. Philips Electrical, Ltd.—Radio circuit arrangements. 24th October, 1949. (676541.)

28952. Western Electric Co., Inc.—Amplifying circuits. 11th November, 1949. (676454.)

29135. Telegraph Construction & Maintenance Co., Ltd.—Moulding and jointing of thermoplastic materials for example in the jointing of electric cables. 14th February, 1951. (676543.)

30893. Thermionic Products, Ltd. (Brush Development Co.). Electromagnetic transducing apparatus. 1st December, 1949. (676652.)

31628. Benford, P. R.—Electrical space-heating appliances. 29th January, 1951. (676655.)

1950

24. Glover & Co., Ltd., W. T., Davey, E. L., and Credland, F. R.—Enclosure for an electric cable joint. 1st January, 1951. (676547.)

653. Peerless & Ericsson, Ltd.—Thermally controlled automatic circuit-breakers for electric circuits. 8th February, 1951. (676657.)

733. Philips Electrical Industries, Ltd.—Luminescent substances for electric discharge tubes. 11th January, 1950. (676753.)

1595. Evans Electronic Developments, Ltd.—Thermostatic electric switches. 13th December, 1950. (676550.)

3472. Standard Telephones & Cables, Ltd.—Electric frequency multiplying or dividing circuits. 9th February, 1951. (676714.)

3759. Philips Electrical Industries, Ltd.—Circuit arrangements for charging a condenser. 14th February, 1950. (676465.)

4481. Tesla, National Corporation, and Vackar, J.—Thermionic valve oscillators. 21st February, 1950. (676716.)

5021. Freeman, W. S.—Electric lampholders and parts thereof. 23rd February, 1951. (676472.)

5957. Ambros, E. D. (trading as Brevetti d'Ambros).—Electric storage battery. 9th March, 1950. (676662.)

6687. Swf-Spezialfabrik für Autozubehor G. Rau Ges.—Electric windscreen wiper motor. 17th March, 1950. (676663.)

6963. Johnson, Matthey, & Co., Ltd.—Radiography. 23rd February, 1951. (676477.)

7787. Naamlooze Vennootschap Optische Industrie de Oude Delft.—Image-conversion apparatus comprising an optical system and an electron-optical system. 28th March, 1950. (676724.)

12135. Nigren, S. D., and Gustafsson, G. E.—Telephone transmitters. 16th May, 1950. (676482.)

12158. Viersen, J. H. Van, and Bender, C. C.—Electric milk-boilers. 16th May, 1950. (676483.)

12527. Voorlas, P. H.—Rheostat mechanism. 18th May, 1950. (676484.)

12715. Westinghouse Electric International Co.—Oscillator circuits. 22nd May, 1950. (676726.)

14975. Fairweather, H. G. C. (Frantz, S. G.).—Magnetic separators. 15th June, 1950. (676487.)

16784. Philips Electrical Industries, Ltd.—Mechanically driven selector switches. 5th July, 1950. (676488.)

16902. Philips Electrical Industries, Ltd.—Gramophone pick-ups. 6th July, 1950. (676489.)

19528. Philips Electrical Industries, Ltd.—Electric discharge tubes comprising a luminescent screen. 4th August, 1950. (676756.)

20139. Radio Corporation of America.—Colour television apparatus. 14th August, 1950. (676670.)

20418. Philco Corporation.—Pulse-echo type radar systems. 17th August, 1950. (676587.)

20649. Standard Telephones & Cables, Ltd.—Printing telegraph receivers. 21st August, 1950. (676588.)

20873. Escher Wyss Akt.-Ges.—Rotor composed of rotary elements axially connected together, for multi-stage axially-flow turbines and compressors. 23rd August, 1950. (676589.)

21068. Philips Electrical Industries, Ltd.—Circuits for transistors. 25th August, 1950. (676590.)

22560. Naamlooze Vennootschap Philips' Gloeilampenfabrieken.—Devices comprising two bodies reciprocating relatively to each other. 13th September, 1950. (676671.)

22761. Bendix Aviation Corporation.—Stylus structure for electrical recorders. 15th September, 1950. (676593.)

23022. Remington Rand, Inc.—Electronic counters or accumulators for use in digital electric calculating apparatus. 19th September, 1950. (676672.)

23280. Philips Electrical Industries, Ltd.—X-ray devices. 22nd September, 1950. (676732.)

23419. Licentia Patent-Verwaltungs-Ges.—Device for recording impulses. 25th September, 1950. (676496.)

23764. Landers, Frary, & Clark.—Electrically-heated liquid containers. 28th September, 1950. (676498.)

24440. Philips Electrical Industries, Ltd.—Super-regenerative receivers for very short waves. 6th October, 1950. (676735.)

29596. Allmanna Svenska Elektriska Aktiebolag.—Means for controlling ionic valves. 4th December, 1950. (676504.)

30766. Igranic Electric Co., Ltd.—Speed control of electric motors. 18th December, 1950. (676505.)

30896. British Thomson-Houston Co., Ltd.—Electrode seals. 19th December, 1950. (676679.)

1951

3787. Allmanna Svenska Elektriska Aktiebolag.—Control systems for asynchronous motors. 16th February, 1951. (676507.)

3934. Holmes, L.—Thermostatic control devices. 19th February, 1951. (676605.)

10149. Gilfillan Bros., Inc.—Single scope two-co-ordinate radar systems. 13th September, 1948. (676760.)

20934. Faulkner, H.—Electrically-operated lighter. 22nd March 1950. (676509.)

TRADE MARK APPLICATIONS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to the dates stated:—

4th July

BERRY'S (design). No. 694,607. Class 9. Electrical switchgear. BERRY'S (design). No. 694,608. Class 11. Pendants, wall brackets, lamp standards, and lamp shades, all being electric light fittings; and electric fires, radiators and water heaters (not parts of machines).—Berry's Electric, Ltd., 85/6, Newman Street, Oxford Street, W.1.

RUTON (design). No. 703,705. Class 9. Floor polishing machines (domestic), vacuum cleaning machines, flat irons, bells, cigar and cigarette lighters, and door openers, all being electrical goods.—Rudolph Blik Electrische Apparatenen Metaalwaren-fabriek N.V., The Hague, Holland. Address for service, c/o A. A. Thornton & Co., Napier House, 24–27, High Holborn, London, W.C.1.

DELTCOS. No. 704,133. Class 9. Electrical apparatus and instruments included in Class 9.—Delta Technical & Commercial Services, Ltd., Elektron Works, Sydenham Road, London, S.E.26.

CARCINOTRON. No. 704,687. Class 9. Electronic valves and radio-electrical apparatus included in Class 9.—Compagnie Générale de Télégraphie sans fil, Paris, France. Address for service, c/o G. F. Redfern & Co., Redfern House, Dominion Street, Finsbury, London, E.C.2.

REDIVOX. No. 705,233. Class 9. Instruments and apparatus and parts thereof included in Class 9 for the production, transmission, reception, amplification, detection, distribution, reproduction, control, measurement or indication of sound waves, light waves or electric waves pertaining to telegraphic, telephonic or acoustic frequency signals.—Central Rediffusion Services, Ltd., Carlton House, Lower Regent Street, London, S.W.1.

VITRATHENE. No. 706,044. Class 9. Insulated electric cables and insulated electric wires.—Alfred Lockhart, Ltd., trading also as Stanley Smith & Co., 77, Worple Road, Isleworth, Middlesex.

TELYTONE. No. 706,236. Class 9.—Apparatus for signalling by means of electrical impulses transmitted over a telecommunication system and adapted to produce audible signals in two or more distinctive tones to indicate a quantity or condition.—Measurement, Ltd., Terminal House, Grosvenor Gardens, London, S.W.1.

TUKO (design). No. 696,400. Class 17. Insulating paper for use in electric condensers.—Papierfabrik Schoeller & Hoesch G.m.o.H., Gernsback, Germany. Address for service, c/o Marks & Clerk, 57 & 58, Lincoln's Inn Fields, London, W.C.2.

11th July

SILMALEC. No. 705,398, Class 9. Wire for electrical purposes included in Class 9, and electric cables.—Aluminium Wire & Cable Co., Ltd., Port Tennant Works, Crymlyn Burrows Road, Port Tennant, Swansea, Glam.

FRIDOR. No. 706,766, Class 9. Radio sets, television sets and electric vacuum cleaners and parts of all such goods included in Class 9.—N. V. Fridor Fabrieken, The Hague, Holland. Address for service, c/o McKenna & Co., 12, Whitehall, London, S.W.1.

"CADET." No. 706,645, Class 9. Electric fans for ventilation.—London Fan & Motor Co., Ltd., 91a, Burghley Road, Tufnell Park, London, N.W.5.

FLAMARIC. No. 706,130, Class 11. Installations for lighting and parts thereof and fittings therefor, all included in Class 11.—Société Anonyme des Anciens Etablissements Guy Daric, Paris, France. Address for service, c/o D. Young & Co., 29, Southampton Buildings, London, W.C.2.

New Zealand Railway Electrification

Electric trains are expected to be operating on the Wellington–Taita route in New Zealand next year and to be extended to Upper Hutt toward the end of 1954. The schedule depends, however, upon the prompt delivery of materials.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Belfast.—1st August. City Council. L.v. switchgear and fire extinguishing equipment for substations. (See this issue.)

India.—MYSORE.—16th July. Government Stores Purchase Committee. Fusegear. (C.R.E. 20907/52. Ten/4158.)*

Pakistan.—KARACHI.—4th August. Director General of Supply and Development. Four 1,000 kW turbo-alternators, two automatic discharge gates, two sets of 11 kV power station switchgear, step-up transformers and ancillary equipment. (C.R.E. 20554/52. Ten/4145.)*

1st July. Department of Supply and Development. Four 500 V air circuit breakers. (C.R.E. 20860/52. Ten/4153.)*

South Africa.—JOHANNESBURG.—3rd July. Stores Department, South African Railways. Supply of 37,200 ft of signalling cable. (C.R.E. 20378/52. Ten/4137.)* Insulators for overhead track equipment.(C.R.E. 20576/52. Ten/4141.)*

17th July. Department of Posts and Telegraphs. Automatic charging rectifiers. (C.R.E. 21027/52. Ten/4160.)*

PRETORIA.—19th August. City Council. Supply of 33 kV cables. Original tender to the Town Clerk, P.O. Box 440, Pretoria. Duplicate tender to Merz & McLellan, Carliol House, Newcastle-on-Tyne.

Uruguay.—MONTEVIDEO.—8th July. Usinas Electricas y Telefonos del Estado. Supply of insulating tape. (C.R.E. 20028/52. Ten/4152.)*

14th July. Insulators and circuit breakers. (C.R.E. 20026/52. Ten/4171.)*

ORDERS PLACED

Crook and Willington.—U.D.C. Supply and erection of 32 street lamps on the Low Mown Meadows estate (£1,168).—North Eastern Electricity Board.

Durham.—County Education Committee. Electrical installation at Hartlepool Throston County School (£1,081).—North of England Engineering & Electrical Co., Ltd. Electrical installation in the new college of further education at Billingham-on-Tees (£19,112). — Troughton & Young, Ltd.

South Shields.—Town Council. Trolley wire for the Transport Department.—British Insulated Callender's Cables, Ltd.

Wakefield.—Corporation. Street lighting work for Barnsley Road improvement (£1,482).—General Electric Co., Ltd.

CONTRACTS IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Atherton.—Blocks of flatted houses at Cross Street, and Derby Street; J. C. Prestwich & Sons, architects, Bradshawgate Chambers, Leigh, Lancs.

Barnard Castle.—Houses (40) at Staindrop for the R.D.C.; J. Lawton, architect, 45, Galgate.

Barnsley.—Houses (106), Yew's Farm estate; borough engineer, Town Hall.

Barrow-in-Furness.—Houses (135), Ormshill estate extensions, for T.C.; borough surveyor.

Basildon.—Houses (214), Fryerns area, for Development Corporation; general manager, Gifford House, London Road, Bowers Gifford, Essex.

Beaulieu.—Fire station, for Hants C.C.; county architect, The Castle, Winchester.

Bebington.—Houses (40), at Mill Park estate for T.C.; T. Warrington & Sons, Ltd., 82, Station Road, Ellesmere Port.

Bexleyheath.—Aged persons' home, Woolwich Road (£41,000); Kent county architect, Springfield, Maidstone.

Birmingham.—School works programme (1952-53): Phase 1 of Teachers' Training College (£412,500); Phase 1 Aldridge Road School (£300,000); Billesley Girls' Grammar (£201,965); Maryvale R.C. Modern (£95,330); Longridge Lane Junior (£65,600); Kings Heath Boys' Grammar (Camp Hill) (£41,835); extensions at Hartfield Crescent Girls' Grammar; Moseley Boys' Grammar; King's Norton Boys' Grammar and Erdington Girls' Grammar (£37,500 each); extensions at Gower Street Boys' Modern (£15,625); Great Barr R.C. Primary (£12,320); Shard End (Long Meadow) Girls' Modern (£211,588); H. J. Manzoni, city engineer.

New cold storage buildings at 44/45, Heath Mill Lane, for F. E. Morriss, Ltd.; John Adams, Ltd., Ashold Farm Road, Edgbaston.

Dwellings (4,422), for 1953, provisionally approved; Alderman A. F. Bradbeer, chairman of House Building Committee.

Blyth.—Steel framed goods shed 120ft long for Blyth Harbour Commissioners; Palmers (Hebburn) Co., Ltd., contractors, Hebburn.

Boldon (Durham).—Houses for U.D.C.; R. Brown & Sons, Ltd., builders, Lord Street, South Shields (38 dwellings), Gordon Durham &

*Specifications may be inspected at the Commercial Relations and Exports Department, Board of Trade, Horse Guards Avenue, Whitehall, S.W.1 (Trafalgar 8855).

Co., East Boldon (28) and W. D. & R. Allison, Whitburn (36).

Bootle.—Factory at Sea View Road for Dock Services, Ltd.; Killender & Killender, architects, 62, Dale Street, Liverpool.

Boston.—Flats (£25,349), Clifton Road estate, Fishtoft, for R.D.C.; Stimpson & Rollston, Ltd., Wyberton West Lane, Boston.

Chelmsford.—Houses (62), Melbourne & Chignall estates; C. S. Wiggins & Sons, 55, Victoria Road, Romford.

Cheltenham.—Flats (204), Arle and Hesters Way estate; Louis de Soissons & Partners, architects, 3, Park Square Mews, N.W.1.

Cheshire.—New hostel block at Wrenbury Colony for C.C.; Jonathan Partington, Ltd., Middleton Junction, Manchester.

Coventry.—New stores at Smithford Street for F. W. Woolworth, Ltd.; F. L. Swinnerton, constructional superintendent, Water Street, Liverpool.

Crawley.—Junior and infants' school, Northgate (£97,877), for West Sussex E.C.; Hoad & Taylor, builders, Market Square, Horsham.

Doncaster.—Erection of Hawthorne (Cantley) Primary School for E.C.; direct labour.

Elgin.—Town hall, to be completed in three stages (£103,000); burgh surveyor, South Street.

Enfield.—Houses, flats, maisonnettes, shops, etc., Bullsmoor Lane (£210,986), for U.D.C.; Townsend & Collins, builders, Goat Lane.

Farnworth.—Houses at Plodder Lane site for U.D.C.: (50), E. F. Davis, Ltd., Bank Street; (50), E. S. Street, Ltd., Bolton Road, Kearsley; (50), W. Lionel Gray (1933), Ltd., Hospital Road.

Folkestone.—Houses (44), Creteway Down, Contract 3; borough engineer, West Terrace.

Gateshead.—Extensions to the Queen Elizabeth Hospital (£250,000); Newcastle and District Regional Hospital Board.

Guildford.—Nurses' home, Royal Surrey County Hospital; South West Metropolitan Regional Hospital Board, London.

Hampton Hill.—Home for old people, Laurel Dene vicinity (£40,390); Middlesex county architect, 10, Great George Street, S.W.1.

Harlow.—Dwellings (85) for Development Corporation; Charles S. Foster & Son, Ltd., builders, Smarts Lane, Loughton.

High Callerton.—Factory and explosives depot; Imperial Chemical Industries, Ltd., Billingham-on-Tees.

Kettering.—Houses (30); Drury & Co., Ltd., Windmill avenue.

Leamington Spa.—Dwellings (199), Whitnash estate; H. Fedeskie, architect, 28, Parade.

Limehurst.—Shops (10) and 16 flats at Crowhill estate; H. Bradshaw, surveyor.

London.—GREENWICH.—Factory, Eastmoor Street; Helical Bar & Engineering Co., Ltd., 82, Victoria Street, S.W.1.

ROTHERHITHE.—Flats (152), Dunton Road and Fort Road; Edwards & Hall, surveyors, 9/10, Blackfriars Road, S.E.1.

WANDSWORTH.—Flats, Fayland estate; Laurence Gotch & Partners, 8, City Road, E.C.1.

Lowestoft.—Houses (72), Whitton estate; borough engineer, 49, High Street.

Manchester.—Extensions to clothing factory at 126, Broughton Street for S. Raven & Co.; J. Rigby Smith, 183, Heywood Road, Prestwich, Manchester.

Restaurant at Ringway Airport; city architect, 140, Deansgate.

Middleton.—Houses (94), Hollin estate; J. Pollard, borough architect, Town Hall.

Morpeth.—Houses (28) at Lynemouth for the R.D.C.; Graham & Mansworth, builders, 454, Denton Road, Newcastle-on-Tyne.

Newcastle-on-Tyne.—Warehouse and canteen, Welbeck Street for Cowper & Dodsworth; Marshall & Tweedy, Grainger House, Blackett Street.

Extensions and alterations, Walkergate Hospital (£10,000); T. Clements & Sons, Selborne Gardens.

Peterborough.—Houses (46) on the Dogsthorpe estate for City Council; city architect, Town Hall.

Plympton St. Mary.—Dwellings (82), shops, etc., St. Maurice estate; P. T. Loosemore, clerk, Rural Council offices.

Poynton (Ches).—Factory at London Road for the Stockdale Engineering Co., Ltd., Manchester; direct labour.

Southampton.—Chest clinic at Royal South Hants Hospital and twin operating theatres at Borough General Hospital; Gutteridge & Gutteridge, architects, 45, Westwood Road.

Depot and offices; Rowntree & Co., Ltd., Cocoa Works, York; staff architect.

South Shields.—Houses (30) at Harton Downhill; J. Reid, borough engineer.

Spennymoor.—Houses (550) on the Middlestone Moor Estate; U.D.C. architect, Town Hall.

Stockton-on-Tees.—Additions to Richard Hind Secondary School, Hartburn Council School, Tilery Road County Boys' School, Newtown County Infants' School, Mill Lane County Girls' School, Richard Hind County Junior School, and Norton High Street County Junior School for the E.C.; borough architect, 28, The Square.

Stourbridge.—Shops, maisonnettes, flats, etc., Norton estate; G. N. Maynard, borough engineer, Council House.

Urmston.—Houses (36) at Nursery Road, Davyhulme for U.D.C.; Humphrey Park Estates, Ltd., Humphrey Lane.

Watford.—New housing estate of about 420 dwellings, Tolpits Lane, for T.C.; borough engineer.

Whitchurch (Salop).—Houses (56) and 12 garages at Sedgford site for U.D.C.; Thos. Warrington & Sons, Ltd., Park Drive, Hoole, Chester.

Widnes.—Phase 1 of Widnes College of Further Education, for C.C.; United Kingdom Construction Co., Ltd., Hammod Road, Kirkby, Liverpool.

Willington.—Houses (100) for Crook and Willington U.D.C.; T. A. Page, Son & Hill, 75, King Street, South Shields.